

FITZ BLDG GRND NG015, NG016 RENO Project Number (PN 23-118391)

PROJECT MANUAL

Contract Documents

September 18, 2023

VOL 1 of 1, Divisions 00 - 28

hord | coplan | macht

HORD COPLAN MACHT 1800 WAZEE STREET, SUITE 450 DENVER, CO 80202 HCM PROJECT NO. 223084.00

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PROJECT DIRECTORY

Owner:

University of Colorado (CU) Anschutz Medical Campus 13001 E. 17th Pl, Aurora, CO 80045 (303) 724-5000

Architect:

Hord Coplan Macht 1800 Wazee Street, Suite 450 Denver, CO 80202 Phone: 303-607-0977

Mechanical, Plumbing Engineer:

Cator Ruma & Associates, Co. 896 Tabor Street Lakewood, CO 80401 Phone: 303-232-6200

Electrical Engineer:

Cator Ruma & Associates, Co. 896 Tabor Street Lakewood, CO 80401 Phone: 303-232-6200





STATE OF COLORADO OFFICE OF THE STATE ARCHITECT STATE BUILDINGS PROGRAMS

BID				
Institution/Agency: University of Colorado - Denver Anschutz Medical Ca	ampus			
Project No./Name: Fitz Bldg Grnd NG015, NG016 Reno / State Project N	No. 23-118391	1		
Bidder Acknowledges Receipt of Addenda Numbers:				
Bidder Anticipates Services outside the United States or Colorado:*	No 🗆	Yes 🗆 If Yes see 3A below		
Bidder will comply with 80% Colorado Labor on project above \$500,000:	Yes□	No 🗆 If No see 3B below		
Bidder is a Service-Disabled Veteran Owned Small Business:*	No 🗆	Yes □ If Yes see 3C below		
Base Bid	\$			
(Refer to Bid Alternate Form SC-6.13.1 Attached, If Applicable)				
Bidder's Time of Completion a. Time Period from Notice to Proceed to Substantial Completion:				
b. Time Period from Substantial Completion to Final Acceptance:				

- c. Total Time of Completion of Entire Project (a + b):
- 1. BID: Pursuant to the advertisement by the State of Colorado dated ______ the undersigned bidder hereby proposes to furnish all the labor and materials and to perform all the work required for the complete and prompt execution of everything described or shown in or reasonably implied from the Bidding Documents, including the Drawings and Specifications, for the work and for the base bid indicated above. Bidders should include all taxes that are applicable.
- 2. EXAMINATION OF DOCUMENTS AND SITE: The bidder has carefully examined the Bidding Documents, including the Drawings and Specifications, and has examined the site of the Work, so as to make certain of the conditions at the site and to gain a clear understanding of the work to be done.
- **3. PARTIES INTERESTED IN BID:** The bidder hereby certifies that the only persons or parties interested in this Bid are those named herein, and that no other bidder or prospective bidder has given any information concerning this Bid.
 - A. If the bidder anticipates services under the contract or any subcontracts will be performed outside the United States or Colorado, the bidder shall provide in a written statement which must include, but need not be limited to the type of services that will be performed at a location outside the United States or Colorado and the reason why it is necessary or advantageous to go outside the United States or Colorado to perform such services. (Does not apply to any project that receives federal moneys) *
 - **B.** For State Public Works projects per C.R.S. 8-17-101, Colorado labor shall be employed to perform at least 80% of the work. Colorado Labor means any person who is a resident of the state of Colorado at the time of the Public Works project. Bidders indicating that their bid proposal will not comply with the 80% Colorado Labor requirement are required to submit written justification along with the bid submission. (Does not apply to any project that receives federal moneys) *
 - **C.** A Service-Disabled Veteran Owned Small Business (SDVOSB) per C.R.S. 24-103-211, means a business that is incorporated or organized in Colorado or maintains a place of business or has an office in Colorado and is officially registered and verified by the Center for Veteran Enterprise within the U.S. Department of Veteran Affairs. Attach proof of certification along with the bid submission. *
 - **D.** Projects estimated to be \$1 million or more that do not receive federal funds are required to comply with the State Apprenticeship Utilization requirements C.R.S. 24-92-115
 - **E.** Projects estimated to be \$500,000 or more that do not receive federal funds are required to comply with the State Prevailing Wage requirements C.R.S. 24-92-201 through 210.
- 4. BID GUARANTEE: This Bid is accompanied by the required Bid Guarantee. Per C.R.S. §24-105-201 If the construction value is \$50,000 or greater a Bid Bond and Power of Attorney or Proposal Guaranty is required in an amount not less than 5% of the total Bid. You are authorized to hold said Bid Guarantee for a period of not more than thirty (30) days after the opening of the Bids for the work above indicated, unless the undersigned bidder is awarded the Contract, within said period, in which event the Office of the State Architect, may retain said Bid Guarantee, until the undersigned bidder

has executed the required Agreement and furnished the required Performance Bond, Labor and Material Payment Bond, and Insurance Policy.

- 5. TIME OF COMPLETION: The bidder agrees to achieve Substantial Completion of the Project from the date of the Notice to Proceed within the number of calendar days entered above, and in addition, further agrees that the period between Substantial Completion and Final Acceptance of the Project will not exceed the number of calendar days noted above. If awarded the Work, the bidder agrees to begin performance within ten (10) days from the date of the Notice to Proceed subject to Article 46, Time of Completion and Liquidated Damages of the General Conditions of the Contract, and agrees to prosecute the Work with due diligence to completion. The bidder represents that Article 7D of the Contractor's Agreement (SC-6.21) has been reviewed to determine the type and amount of any liquidated damages that may be specified for this contract.
- 6. EXECUTION OF DOCUMENTS: The bidder understands that if this Bid is accepted, bidder must execute the required Agreement and furnish the required Performance Bond, Labor and Material Payment Bond, Insurance Policy and Certificates of Insurance within ten (10) days from the date of the Notice of Award, and that the bidder will be required to sign to acknowledge and accept the Contract Documents, including the Drawings and Specifications.
- 7. ALTERNATES: Refer to the Information for Bidders (SC-6.12) for Method of Award for Alternates and use State Form SBP-6.13.1 Bid Alternates form to be submitted with this bid form if alternates are requested by the institution/agency in the solicitation documents.
- 8. Submit wage rates (direct labor costs) for prime contractor and subcontractor as requested by the institution/agency in the solicitation documents.

9. The right is reserved to waive informalities and to reject any and all Bids.

*Does not apply to projects for Institutions of Higher Education that have opted out of the State Procurement Code.

SIGNATURES: If the Bid is being submitted by a Corporation, the Bid shall be signed by an officer, i.e., President or Vice-President. If a sole proprietorship or a partnership is submitting the Bid, the Bid shall so indicate and be properly signed.

Dated this	Day of	, 20	
THE BIDDER:			
Company Name			Address (including city, state and zip)
Phone number:			
Name (Print) and Title			Signature



STATE OF COLORADO OFFICE OF THE STATE ARCHITECT STATE BUILDINGS PROGRAM

BID ALTERNATES FORM

Institution/Agency: <u>University of Colorado - Denver Anschutz Medical Campus</u> Project No./Name: Fitz Bldg Grnd NG015, NG016 Reno / State Project No. 23-118391

Additive alternates will not be used if deductible alternates are used and deductible alternates will not be used if additive alternates are used.

Additive Alternates (If Applicable)

Refer to Drawings Cover Sheet for descriptions of add alternates. If the add alternates are accepted, the base bid would be modified by the amount entered by the bidder.

A.A. No. 1	Training Room	Add \$
A.A. No. 2	Office Suite	Add \$
A.A. No. 3	Training Room	Add \$
A.A. No. 4	Training Room	Add \$
A.A. No. 5		Add \$
A.A. No. 6		Add \$
A.A. No. 7		Add \$
A.A. No. 8		Add \$
A.A. No. 9		Add \$
A.A. No. 10		Add \$

Deductive Alternates (If Applicable)

Refer to specification section ______ for descriptions of the deductive alternates. If the deductive alternates are accepted, the base bid would be modified by the amount entered by the bidder.

D.A. No. 1	Deduct \$	
D.A. No. 2	Deduct \$	
D.A. No. 3	Deduct \$	
D.A. No. 4	Deduct \$	
D.A. No. 5	Deduct \$	
D.A. No. 6	Deduct \$	
D.A. No. 7	Deduct \$	
D.A. No. 8	Deduct \$	
D.A. No. 9	Deduct \$	
D.A. No. 10	Deduct \$	

THE BIDDER:

Company Name

Signature

Date

SECTION 01 00 00 - GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Design Requirements:
 - 1. Designer Responsibility: Based on a series of meetings with the University Project Manager and applicable University staff, draft Division 01 Specification Sections consistent with State of Colorado Construction Contract provisions, General and Supplementary Conditions of the Contract, including requirements for administrative procedures consistent with the size and scope of the project.
 - 2. Content: Include, as applicable, the following Sections:
 - a. SECTION 01 00 00 SUMMARY.
 - b. SECTION 01 25 00 SUBSTITUTION PROCEDURES.
 - c. SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES.
 - d. SECTION 01 31 00 PROJECT MANAGEMENTS AND COORDINATION.
 - e. SECTION 01 32 33 PHOTOGRAPHIC DOCUMENTATION.
 - f. SECTION 01 33 00 SUBMITTAL PROCEDURES.
 - g. SECTION 01 35 00 SPECIAL PROCEDURES.
 - 1) This Section includes special environment health and safety procedures unique to work at University projects.
 - h. SECTION 01 35 46 INDOOR AIR QUALITY PROCEDURES
 - 1) This Section includes special procedures required by the University to maintain a high level of indoor air quality both during construction and subsequent to occupancy.
 - i. SECTION 01 40 00 QUALITY REQUIREMENTS.
 - j. SECTION 01 41 00 REGULATORY REQUIREMENTS.
 - k. SECTION 01 42 00 REFERENCES.
 - 1. SECTION 01 50 00 TEMPORARY FACILITIES AND CONTROLS.
 - m. SECTION 01 60 00 PRODUCT REQUIREMENTS.
 - n. SECTION 01 73 00 CLOSEOUT PROCEDURES.
 - o. SECTION 01 74 19 CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.
 - p. SECTION 01 78 23 OPERATION AND MAINTENANCE DATA.
 - q. SECTION 01 78 39 PROJECT RECORD DOCUMENTS.
 - r. SECTION 01 78 46 EXTRA STOCK MATERIALS.
 - s. SECTION 01 79 00 DEMONSTRATION AND TRAINING.
 - t. SECTION 01 81 13 SUSTAINABLE DESIGN REQUIREMENTS.
 - u. SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 01 00 00

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Project information.
 - 2. Work covered by Contract Documents.
 - 3. Contractor's use of site and premises.
 - 4. Coordination with occupants.
 - 5. Work restrictions.
 - 6. Specification and Drawing conventions.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.
 - 2. Section 017300 "Execution" for coordination of Owner-installed products.

1.3 PROJECT INFORMATION

- A. Project Identification: CU Anschutz Fitz 1st Floor Renovation.
 - 1. Project Location: CU Anschutz Campus.
 - 2. HCM Project Number: 223084.00.
 - 3. State Project Number: 23-118391.
- B. Owner: University of Colorado (CU) Anschutz Medical Campus, 13001 E. 17th PI, Aurora, CO 80045, (303) 724-5000.
- C. Architect: Hord Coplan Macht Inc., 1800 Wazee Street, Ste. 450, Denver, CO 80202, 303-607-0977, www.hcm2.com. Contact: Michelle Horn, mhorn@hcm2.com.
- D. Architect's Consultants: Architect has retained the following design professionals, who have prepared designated portions of the Contract Documents:
 - 1. Mechanical, Plumbing Engineer:
 - a. Cator Ruma & Associates, Co., 896 Tabor Street, Lakewood, CO 80401, 303-232-6200.
 - 2. Electrical Engineer:

- a. Cator Ruma & Associates, Co., 896 Tabor Street, Lakewood, CO 80401, 303-232-6200.
- E. Contractor: To be determined.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and includes, but is not limited to, the following:
 - 1. First floor interior renovation of an existing building, and other Work indicated in the Contract Documents.
- B. Type of Contract:
 - 1. Project will be constructed under a single prime contract.

1.5 WORK UNDER OWNER'S SEPARATE CONTRACTS

- A. Work with Separate Contractors: Cooperate fully with Owner's 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 Owner's separate contracts.
- B. Concurrent Work: Owner will award separate contract(s) for the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
 - 1. Low-voltage/information technology, systems, cabling, and terminations by CU OIT.

1.6 OWNER-FURNISHED/OWNER-INSTALLED (OFOI) PRODUCTS

- A. The Owner will furnish and install products indicated.
- B. Owner-Furnished/Owner-Installed (OFOI) Products: As indicated on Drawings.

1.7 CONTRACTOR'S USE OF SITE AND PREMISES

- A. Restricted Use of Site: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Limits on Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 - 1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or for storage of materials.

- a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
- b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations.
- D. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.8 COORDINATION WITH OCCUPANTS

- A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.9 WORK RESTRICTIONS

- A. Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets, work on public streets, rights of way, and other requirements of authorities having jurisdiction.
- B. On-Site Work Hours: Limit work to normal business working hours of 8:00 a.m. to 5:00 p.m., Monday through Friday, unless otherwise indicated. Work hours may be modified to meet Project requirements if approved by Owner and authorities having jurisdiction.
 - 1. Weekend Hours: As permitted by Owner.
 - 2. Early Morning Hours: As permitted by Owner.
 - 3. Hours for Utility Shutdowns: As permitted by Owner.
 - 4. Hours for Loud/Noisy Activity: As permitted by Owner and authorities having jurisdiction.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging for temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions, or as otherwise permitted by Owner.
 - 2. Obtain Owner's written permission before proceeding with utility interruptions.
- D. Noise, Vibration, Dust, and Odors: Coordinate operations that may result in high levels of noise and vibration, dust, odors, or other disruption to Owner occupancy with Owner.

- 1. Notify Owner not less than two days in advance of proposed disruptive operations, or as otherwise permitted by Owner.
- 2. Obtain Owner's written permission before proceeding with disruptive operations.
- E. Smoking and Controlled Substance Restrictions: Use of tobacco products, alcoholic beverages, and other controlled substances on Project site is not permitted.
- F. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Text Color: Text used in the Specifications, including units of measure, manufacturer and product names, and other text may appear in multiple colors or underlined as part of a hyperlink; no emphasis is implied by text with these characteristics.
 - 3. Hypertext: Text used in the Specifications may contain hyperlinks. Hyperlinks may allow for access to linked information that is not residing in the Specifications. Unless otherwise indicated, linked information is not part of the Contract Documents.
 - 4. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 00 Contracting Requirements: General provisions of the Contract, including General and Supplementary Conditions, apply to all Sections of the Specifications.
- C. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- D. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings and published as part of the U.S. National CAD Standard.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01 18 00

PROJECT UTILITY SOURCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes matrix of utility sources applicable to Project.

1.3 QUALITY ASSURANCE

A. Comply with utility company and regulatory agency codes, standards, and guidelines for the provision of new or extension of exiting utilities.

1.4 UTILITY SOURCE MATRIX

A. The following matrix summarizes utility responsible for provision of utility service:

	AMC			DC		АМС		DC		
	Trunk		In Tract		Trunk	In Tract	Trunk	In Tract	Trunk	In Tract
Steam	University	Note 1	Developer		Xcel	University	University	University	DW	University
Chilled Water	University	Note 1	Developer		NA	University	University	University	NA	University
Electricity	University	Note 2	Developer		Xcel	University	University	University	DW	University
Storm Drainage	COA		Developer		DW	University	University/ COA Note 5	University	DW	University
Sanitary Sewer	COA		Developer		DW	University	University/ COA Note 5	University	DW	University
Water	COA		Developer		DW	University	University/ COA Note 5	University	DW	University
Telecommunications	University	Note 3	Developer	Note 3	University	University	University	University	DW	University
Natural Gas	Xcel	Note 4	Developer		Xcel	University	University	University	DW	University
University: University of Colorado Denve		o Denver	<i>Note 1</i> : University owns Trunk steam and chilled water from CUP to vault							
COA: City of Aurora			Note 2: Univ	Note 2 : University owns Trunk electrical from switch gear to manhole						
DW: Denver Water			<i>Note 3</i> : Univ Developer ov	<i>lote 3</i> : University owns Trunk telecom ductbank from main switch to manhole. Developer owns cable from switch to building						
			Note 4: Xcel	Note 4: Xcel has license agreement with University						
Developer:			<i>Note 5</i> : University and COA jointly permit							
University, TCH, UCH. In Tract lines are owned by the building they are feeding										

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 18 00

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing allowances.
 - 1. Certain items are specified in the Contract Documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.
- B. Types of allowances include the following:
 - 1. Lump-sum allowances.
 - 2. Unit-cost allowances.
 - 3. Quantity allowances.
- C. Related Requirements:
 - 1. Section 01 22 00 "Unit Prices" for procedures for using unit prices.

1.3 SELECTION AND PURCHASE

- A. At the earliest practical date after award of the Contract, advise Architect/Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.
- B. At Architect/Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.
- C. Purchase products and systems selected by Architect/Engineer from the designated supplier.

1.4 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.5 INFORMATIONAL SUBMITTALS

- A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.
- B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.
- C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.6 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.7 LUMP-SUM, UNIT-COST, AND QUANTITY ALLOWANCES

- A. Allowance shall include cost to Contractor of specific products and materials ordered by University or selected by Architect/Engineer under allowance and shall include taxes, freight, and delivery to Project site.
- B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by University and/or selected by Architect/Engineer under allowance shall be included as part of the Contract Sum and not part of the allowance.
- C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to University, after installation has been completed and accepted.
 - 1. If requested by Architect/Engineer, retain and prepare unused material for storage by University. Deliver unused material to University's storage space as directed.

1.8 ADJUSTMENT OF ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 - 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 - 2. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 - 3. University reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.
 - 1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.

2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

- A. Allowance No. 1: Unforeseen Conditions (Lump Sum Allowance): Provide an allowance of \$10,000 to remove existing abandoned equipment concealed above finished spaces, if any.
- B. Allowance No. 2: Existing Roofing Patch/Repair (Quantity Allowance): Provide an allowance to furnish and install new fully-adhered membrane roofing to tie-into and match existing membrane roofing, at removed equipment and penetrations indicated on Drawings. Include FRT plywood decking, vapor retarder, two-layers polyisocyanurate insulation, and primed glass-mat gypsum cover-board. Field-verify existing membrane roofing type, presumed to be 60-mil white (liquid-coated) EPDM.

END OF SECTION 01 21 00

SECTION 01 23 00

ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if University decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
 - 3. Selection of alternates described in this Section may be deferred for possible selection at a subsequent date if so indicated in the Agreement.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

1. Alternate descriptions are recognized as abbreviated and incomplete. Correlate the descriptions with applicable Specification Sections and Drawings for the provision of complete and coordinated work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- 3.1 SCHEDULE OF ALTERNATES
 - A. See Drawings Cover Sheet for design Alternates.

END OF SECTION 01 23 00

SECTION 01 25 00

SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for substitutions.
- B. Related Requirements:
 - 1. Section 01 21 00 "Allowances" for products selected under an allowance, if applicable.
 - 2. Section 01 23 00 "Alternates" for products selected under an alternate, if applicable.
 - 3. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
 - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
 - 2. Substitutions for Convenience: Changes proposed by Contractor or University that are not required in order to meet other Project requirements but may offer advantage to Contractor or University.

1.4 ACTION SUBMITTALS

- A. Substitution Requests: Submit each request for consideration in format and quantities specified in Section 01 33 00 "Submittal Procedures". Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use CSI Form 13.1A or Contractor-generated form with substantially the same information.
 - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.

- b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by University and separate contractors that will be necessary to accommodate proposed substitution.
- c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
- d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
- e. Samples, where applicable or requested.
- f. Certificates and qualification data, where applicable or requested.
- g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
- h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
- i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
- j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
- k. Cost information, including a proposal of change, if any, in the Contract Sum.
- 1. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
- m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
- 3. Architect/Engineer's Action: If necessary, Architect/Engineer in consultation with the University will request additional information or documentation for evaluation within seven calendar days of receipt of a request for substitution. Architect/Engineer in consultation with the University will notify Contractor of acceptance or rejection of proposed substitution within 14 calendar days of receipt of request, or seven calendar days of receipt of additional information or documentation, whichever is later.
 - a. Forms of Acceptance: Change Order.
 - b. Use product specified if Architect/Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

1.6 PROCEDURES

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

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 14 calendar days prior to time required for preparation and review of related submittals.
 - 1. Conditions: Architect/Engineer in consultation with the University will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will return requests without action, except to record noncompliance with these requirements:
 - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - b. Requested substitution provides sustainable design characteristics that specified product provided.
 - c. Substitution request is fully documented and properly submitted.
 - d. Requested substitution will not adversely affect Contractor's construction schedule.
 - e. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - f. Requested substitution is compatible with other portions of the Work.
 - g. Requested substitution has been coordinated with other portions of the Work.
 - h. Requested substitution provides specified warranty.
 - i. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00

CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.
 - 2. Contractor's Agreement Design/Bid/Build, State Form SC-6.21 and The General Conditions of the Construction Contract Design/Bid/Build, State Form SC-6.23 for definitions and contractual requirements related to contract modification procedures.

1.3 DEFINITIONS

A. Change Order: A written order in compliance with the requirements of the Contract authorizing changes in the Work. For the purposes of this Section a Change Order and a Contract Amendment shall have the same meaning.

1.4 INFORMATIONAL SUBMITTALS

A. Contractor's Authorized Signatory: Submit name of individual authorized to accept changes and responsible for informing others employed by Contractor of changes in the Work.

1.5 MINOR CHANGES IN THE WORK

A. Architect/Engineer will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.6 CHANGE ORDER BULLETIN

A. University-Initiated Change Order Bulletin: Architect/Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. It will also state the time period for which the request will remain valid.

- 1. Change Order Bulletin Form: State Form SC-6.311 available on the website of the Office of the State Architect.
- 2. Work Change Order Bulletins issued by Architect/Engineer are not instructions either to stop work in progress or to execute the proposed change.
- B. Contractor-Initiated Change Order Bulletin: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect/Engineer.
 - 1. Change Order Bulletin Form: State Form SC-6.311 available from the website of the Office of the State Architect.
 - 2. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.

1.7 CHANGE ORDER PROPOSAL

- A. Change Order Proposal: In response to a University-Initiated Change Order Bulletin or accompanying a Contractor-Initiated Change Order Bulletin, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change described.
 - 1. Change Order Proposal Form: State Form SC-6.312 available from the website of the Office of the State Architect.
 - 2. Labor Rates: Prior to submitting first Change Order Proposal, submit bare, unburdened hourly labor rates for all contractor and subcontractor labor categories; submit itemized breakdown of all applicable additional labor benefit costs to be added to the bare labor cost to arrive at the total burdened hourly labor cost.
 - 3. Equipment Costs: Provide cost backup for all equipment clearly indicating equipment billing rates and sufficient to demonstrate, as determined by the University Project Manager, that proposed rates are competitive and reasonable in all cases. Submit completed Change Order Proposal Form within the requested timeframe. Include backup documentation to support calculations consistent with Contract provisions, including but not limited to, the following:
 - a. Contractor and Subcontractor labor, material and equipment costs including:
 - 1) A list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 2) Applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 3) Costs of labor and supervision directly attributable to the change and as permitted by the terms and conditions of the General Contract for Construction.
 - b. Contractor and Subcontractor overhead and profit.
 - c. Contractor's bond cost.
 - d. Justification for Change in Contract Time: An updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 4. Maintain detailed records of work completed. Provide complete information for evaluation of proposed changes and to substantiate proposed changes in Contract Sum or Contract Time.

1.8 ADMINISTRATIVE CHANGE ORDERS

- A. Allowance Adjustment: See Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.
- B. Unit-Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.9 CHANGE ORDER PROCEDURES

- A. Submit three signed copies of Change Order Proposal to Architect/Engineer for review.
 - 1. University-Initiated Change Order Bulletins: University and Architect/Engineer will evaluate Contractor's Change Order Proposal and either request additional information or suggest modifications. Based on this review and evaluation University will either accept or reject the proposal.
 - 2. Contractor-Initiated Change Order Bulletins: Architect/Engineer will evaluate Contractor's claim based on the terms and conditions of the Contractor Agreement and General Conditions of the Construction Contract, as applicable.
 - 3. Architect/Engineer's Action: When satisfied as to the accuracy and completeness of the Change Order Proposal, the Architect/Engineer will sign all three copies and forward to the University for consideration.
- B. On University's approval of a Change Order Proposal, Architect/Engineer will prepare, sign and forward three copies of a Change Order, State Form SC-6.31 available from the website of the Office of the State Architect, for signature by the Contractor. Contractor then forwards all three copies of signed Change Order to the University for signature and distribution of fully executed copies to Architect/Engineer and Contractor for record.
- C. Upon receipt of a fully executed Change Order, promptly perform the following:
 - 1. Revise Schedule of Values on the Application for Payment Form by indicating each authorized Change Order as a separate line item and adjusting the Contract Sum as shown on the Change Order.
 - a. University will not pay for changes to the Work until authorized by a Change Order signed by all parties.
 - 2. Revise the Progress Schedule to reflect any change in the Contract Time.
 - 3. Enter changes in the Project Record Documents.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00
SECTION 01 29 00

PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Requirements:
 - 1. Section 01 21 00 "Allowances" for procedural requirements governing the handling and processing of allowances.
 - 2. Section 01 22 00 "Unit Prices" for administrative requirements governing the use of unit prices.
 - 3. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 4. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.
 - 5. For projects required to obtain LEED certification, Division 01 Section "Sustainable Design Requirements" for administrative requirements governing submittal of cost breakdown information required for LEED documentation.

1.3 DEFINITIONS

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

1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Schedule of values report from cost-loaded Critical Path Method Schedule prepared in accordance with Section 01 32 00 "Construction Progress Documentation" may serve to satisfy requirements for the schedule of values.
 - 1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with continuation sheets.
 - b. Submittal schedule.
 - c. Items required to be indicated as separate activities in Contractor's construction schedule.

- 1) Construction Manager's Fee.
- 2) Estimated Project General Conditions Costs.
- 2. Submit schedule of values and hold a conference with the Architect/Engineer and University Project Manager to finalize the schedule of values at earliest possible date, but no later than 10 business days before the date scheduled for submittal of initial Certificates and Applications for Payment.
- 3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.
- B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the schedule of values:
 - a. Project name and location.
 - b. Name of Architect/Engineer.
 - c. Architect/Engineer's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 - 2. Arrange schedule of values consistent with format of AIA Document G703.
 - 3. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers) that affect value.
 - g. Dollar value of the following, as a percentage of the Contract Sum to nearest onehundredth percent, adjusted to total 100 percent.
 - 1) Labor.
 - 2) Materials.
 - 3) Equipment.
 - 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - a. Include separate line items under Contractor and principal subcontracts for LEED documentation, where applicable, and other Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 - 6. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

- 7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not a direct cost of actual work-inplace shall be shown as separate line items in the schedule of values.
- 8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect/Engineer and paid for by University.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Pay Application and Schedule Review Meetings: Conduct in accordance with Section 01 31 00 "Project Management and Coordination." Provide draft application for payment and draft schedule update reflecting work accomplished during previous pay period. Review progress achieved; discuss and resolve issues affecting the progress; and review critical activities to be accomplished during the following 90 calendar days.
 - 1. Jobsite Walk: When required, conduct a walk of the jobsite to confirm progress related to any activity in question.
- C. Monthly Schedule Reporting: Upon conclusion of the Pay Application and Schedule Review Meeting, but not later than the 28th of the month, update the Construction Schedule and submit the Pay Application.
- D. Payment Application Times: Submit Application for Payment to Architect/Engineer by the first day of the month and no more than five (5) business days prior thereto. The period covered by each Application for Payment is per the date indicated in the Application.
- E. Payment Application Review: The Architect/Engineer shall, within five (5) business days after the receipt of each Certificate and Application for Payment, review the Project Application for Payment and either execute a Project Certificate for Payment to the University or notify the Contractor in writing of the reasons for withholding a Certificate.
 - 1. All applications for payment, except the final application, and the payments there under, shall be subject to correction in the next application rendered following the discovery of any error
- F. Application for Payment Forms: Use State Form SBP-7.2 "Certification for Contractor Payment."
- G. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect/Engineer will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.

- 3. Include amounts of Change Orders issued before last day of construction period covered by application.
- 4. Indicate separate amounts for work being carried out under University-requested project acceleration.
- H. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site as approved in advance by the University Project Manager and items stored at an off-site location previously agreed upon in writing.
 - 1. Provide certificate of insurance, evidence of transfer of title to University, and consent of surety to payment, for stored materials.
 - 2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
 - 3. Provide summary documentation for stored materials indicating the following:
 - a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
 - b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
 - c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.
- I. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect/Engineer by a method ensuring receipt. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- J. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
 - 1. List of subcontractors.
 - 2. Schedule of values.
 - 3. For projects required to obtain LEED certification, LEED submittal for project materials cost data.
 - 4. Contractor's construction schedule (preliminary if not final).
 - 5. Products list (preliminary if not final).
 - 6. For projects required to obtain LEED certification, LEED action plans.
 - 7. Schedule of unit prices.
 - 8. Submittal schedule (preliminary if not final).
 - 9. List of Contractor's staff assignments.
 - 10. List of Contractor's principal consultants.
 - 11. Copies of building permits.
 - 12. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 - 13. Initial progress report.
 - 14. Report of preconstruction conference.
- K. Application for Payment at Substantial Completion: After Architect/Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

- 1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
- 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for University occupancy of designated portions of the Work.
- L. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
 - 1. All items on Pre-acceptance Checklist (State Form SBP-05) have been completed.
 - 2. Notice of Acceptance (State Form SBP-6.27) has been issued.
 - 3. Statements to support local sales tax refunds, if any submitted.
 - 4. Notice of Contractor's settlement has been published.
 - 5. Evidence of completion of Project closeout requirements, including but not limited to:
 - a. Submittal of Record Documents.
 - b. Submittal of all Operation and Maintenance Manuals.
 - c. Completion of all required demonstration and training.
 - 6. Updated final statement, accounting for final changes to the Contract Sum.
 - 7. Evidence that claims have been settled.
 - 8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when University took possession of and assumed responsibility for corresponding elements of the Work.
 - 9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

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SECTION 01 31 00

PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. General coordination procedures.
 - 2. Coordination drawings.
 - 3. Requests for Information (RFIs).
 - 4. Project Web site.
 - 5. Project meetings.

B. Related Requirements:

- 1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
- 2. Section 01 73 00 "Execution" for procedures for coordinating general installation and fieldengineering services, including establishment of benchmarks and control points.
- 3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

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

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Within 21 calendar days of Notice of Award submit, as complete as possible, a preliminary list to include all major subcontractors. Augment, complete and submit the final subcontractor list within 60 calendar days of Notice of Award, unless a longer duration is approved by the Architect/Engineer. Include the following information in tabular form:
 - 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

- B. Key Personnel Names: Within 14 calendar days after Notice to Proceed, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
 - 1. Post copies of list in project meeting room, in temporary field office, [on Project Web site,] and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

- A. General: Each entity involved in the performance of work for the entire Project shall cooperate in the overall coordination of the Work; promptly, when requested, furnish information concerning its portion of the Work; and respond promptly and reasonably to the decisions and requests of persons designated with coordination, supervision, administrative or similar authority.
 - 1. University Standard Project Management Forms
 - a. Where applicable, obtain from the University Project Manager and use the following University Standard Forms:
 - 1) Preconstruction Agenda
 - 2) Change Order Log with Contingency Codes
 - 3) Access Control Badge Application Form
 - 4) Utility Interruption Request Form
 - 5) Utility Start-Up Request Form
 - 6) Fire Alarm/Sprinkler Disable Request Form
 - 7) Hot Work Permit Form
 - 8) Anschutz Medical Campus (AMC) Street and Parking Lot Closure Form
 - 9) Indoor Air Quality (IAQ) Planning Checklist
 - 10) Indoor Air Quality (IAQ) Inspection Checklist
 - 2. Site Utilization:
 - a. In addition to the site utilization limitations and requirements indicated in Section 01 10 00 "Summary" and indicated by the Contract Documents; administer the allocation of available space equitably among entities needing access and space, so as to produce the best overall efficiency in the performance of the total work of the project. Schedule deliveries so as to minimize the space and time requirements for storage of materials and equipment on the site; but do not unduly risk delays in the work.
 - b. Concurrent with work of the Contractor, other contractors, suppliers, and the University personnel may be working in relatively close proximity. The Contractor is solely responsible for coordinating their work with that of other contractors and will make no claims for failure to do so.
 - 3. Layout:
 - a. It is recognized that the Contract Documents are diagrammatic in showing certain physical relationships of the various elements and systems and their interfacing with other elements and systems. Establishment and coordination of these relationships is the exclusive responsibility of the Contractor. Do not scale the drawings. Lay out and arrange all elements to contribute to safety, efficiency and to carry the harmony of design throughout the Work. In case of conflict or undimensioned locations, verify required positioning with Architect/Engineer.

4. Substrate Examination:

- a. The Installer of each element of the work must examine the conditions of the substrate to receive the work, dimensions and spaces adjacent, tolerances, interfacing with other elements and services, and the conditions under which the work will be performed, and must notify the Contractor in writing of conditions detrimental to the proper or timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.
- 5. Large and Heavy Equipment:
 - a. Contractor to coordinate with University Project Manager requirements to be maintained for the subsequent entry of large equipment units. Coordinate the movement of heavy items with shoring and bracing, so that the building structure will not be overloaded during the movement and installation.
 - b. Where equipment or products to be installed on the roof are too heavy to be hand-carried, do not transport across roof deck; position by crane or other device so as to avoid overloading the roof deck.
- B. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections of the Specification that depend on each other for proper installation, connection, and operation.
 - 1. Contractor Communication with the University: Direct all communication with the University through the University Project Manager.
 - 2. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 - 3. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 - 4. Make adequate provisions to accommodate items scheduled for later installation.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
 - 1. Prepare similar memoranda for University and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
 - 1. Preparation of Contractor's construction schedule.
 - 2. Preparation of the schedule of values.
 - 3. Installation and removal of temporary facilities and controls.
 - 4. Delivery and processing of submittals.
 - 5. Progress meetings.
 - 6. Preinstallation conferences.
 - 7. Project closeout activities.
 - 8. Startup and adjustment of systems.
- E. Coordination Of Submittals: Prior to transmittal to the Architect/Engineer, review shop and erection drawings, product data, and samples for compliance with Contract Documents and for coordination

among work of all Sections of the Specifications. Coordination of submittals shall include, but not be limited to the following:

- 1. Verification of field dimensions and clearances and relationship to available space and anchors.
- 2. Verification of compatibility with equipment and work of other Sections, electrical characteristics, and operational control requirements.
- 3. Verification of motor voltages and control characteristics.
- 4. Coordination of controls, interlocks, wiring of pneumatic switches, and relays.
- 5. Coordination of wiring and control diagrams.
- 6. Review of the effect of any changes on work of other Sections.
- 7. For any item to be installed in or on a finished surface, certify that applicable Contract Documents have been checked and that the item submitted is compatible with the surface finish on which it is to be installed.
- 8. Equipment and material submittals shall show sufficient data to indicate complete compliance with Contract Documents as follows:
 - a. Proper sizes and capabilities.
 - b. Ability to fit in the available space in a manner that will allow proper service.
 - c. Construction methods, materials, and finishes.
 - d. List of accessories.
- F. Special Coordination Requirements for Mechanical and Electrical Work:
 - 1. General: Provide necessary work and services required to coordinate the complete installation of heating, ventilating, and air conditioning (HVAC) equipment and systems; plumbing systems and fixtures; electrical equipment, fixtures, and systems; and other equipment or systems containing motors and controls or requiring connection to mechanical or electrical systems; all so that the various systems perform as indicated and are in harmony with other project Work.
 - 2. Contract Drawings:
 - a. Drawings are schematic in nature, and indicate in general how the various components are integrated with other parts of the building. Coordinate exact locations by job measurement, by verifying the requirements of other trades, and by review of Contract Documents.
 - 3. Mechanical and Electrical Drawings indicate general routing of the various parts of the systems, but do not indicate all sizes, fittings, offsets, and runouts which are required. Coordinate correct sizes, fittings, offsets, and runouts required to fit systems into allocated spaces. Coordinate locations of all light fixtures, vents, and supply grilles to conform to the ceiling grid system or other modular finishes.
 - 4. Coordinate installation of mechanical and electrical work in compliance with the following requirements:
 - a. Install piping, ductwork and similar services straight and true, aligned with other work, close to walls and overhead structure, allowing for insulation, concealed (except where indicated as exposed) in occupied spaces, and out-of-the-way with maximum passageway and headroom remaining in each space.
 - b. Install electrical work in a neat, organized manner with conduit and similar services in or parallel with building lines, and concealed unless indicated as exposed.
 - c. For all work maintain maximum practical overhead clearance but not less than 6" above ceiling. Where exposed, maintain 7'-0" minimum clearance.
 - d. Arrange all work to facilitate maintenance and repair or replacement of equipment. Locate services requiring maintenance on valves and similar units in front of services requiring less maintenance. Connect equipment for ease of disconnecting, with minimum of interference with other work.

- e. Provide space to permit removal of coils, tubes, fan shafts, filters, other parts which may require replacement.
- f. Locate operating and control equipment and devices for easy access. Furnish access panels where units are concealed by finishes and similar work.
- g. Integrate mechanical work in ceiling plenums with suspension system, light fixtures and other work, so that required performances of each will be achieved.
- h. Give the right-of-way to piping systems required to slope for drainage over other service lines and ductwork.
- i. Advise other trades of openings required in their work for accommodation of mechanical and electrical elements. Provide and place sleeves and anchors required in other work.
- 5. Access to Equipment: Except where located above accessible ceilings, provide access panels wherever access is required to concealed valves, controls, dampers, pull boxes and other devices requiring ongoing or periodic access.
 - a. Acceptable types of access panels are specified in Division 08.
 - b. Each trade is responsible for providing access panels needed for access to their equipment and coordinating installation with other Division 03, 04, 06 and 09 trades.
 - c. Coordinate requirements and obtain approval of locations from Architect/Engineer.
- G. Compatibility of Systems:
 - 1. Provide products and equipment which are compatible with other work requiring mechanical/electrical interface including electrical connections, control devices, water, drain and other piping connections. Verify electrical characteristics, fuel requirements and other interface requirements before ordering equipment and resolve conflicts that may arise.
 - 2. Coordinate equipment, mechanical and electrical work in accordance with the following schedule:

ITEM	<u>FURNISHED</u> <u>BY</u>	<u>MOUNTED</u> <u>BY</u>	LOW VOLTAGE WIRED	POWER WIRED & CONNECTED	LOW VOLTAGE CONTROL
				<u>D1</u>	<u>BY</u>
Equipment motors	Ι	MI	MI	EI	
Motor starters,	MI	EI	EI	EI	MI
contactors and					
overload heaters					
Fused and unfused	EI**	EI**	EI**	EI	
disconnect switches					
Manual operating switches, speed switches, push-button	MI	EI	EI	EI	EI
stations and pilot lights					
Duct detectors	EI	MI	MI	EI	MI
Control relays and transformers	MI	MI	MI	EI	MI
Thermostats, time switches*	MI	MI	MI	EI	MI
Temperature control panels	MI	MI	MI	EI	MI
Motor and solenoid valves, damper	MI	MI	MI		MI

motors, PE and EP								
switches								
Refrigeration	MI	MI	MI	EI	MI			
equipment, cooling								
tower and controls								
Electric meters	EI	EI	EI	EI	MI			
Steam meters	MI	MI	MI	MI	MI			
Chilled water meters,	MI	MI	MI	MI	MI			
Water meters	MI***	MI	MI	MI	MI			
Natural Gas	MI	MI	MI	MI	MI			
 I = Installer of equipment requiring electrical service EI = Electrical Installer MI = Mechanical Installer * Motor driven units which are controlled from line voltage automatic controls such as line voltage thermostats, float switches or time switches which conduct full load current of the motor shall be wired for both power and control circuit under the electrical contract. However, if the control device does not conduct full load current, then the responsibility shall be that set forth in the above schedule. (Example: a 208 volt, 3-phase, 3- wire motor requires 120 volt control. Electrical Installer shall furnish a 120 volt circuit for control and 208 volt circuit.) ** Disconnects for AH units are factory mounted. ***Building Service meter provided by Civil. Any sub meter provided by MI. Coordinate meter requirements with utility for remote monitoring by 23 09 00 – Instrumentation and Controls. 								

- H. Special Coordination Requirements for Exterior Envelope Work:
 - 1. General: Provide necessary work and services required to coordinate the complete and continuous installation of the building's heat, air and moisture barriers. Exterior building envelope construction to be coordinated includes, but is not limited to, below-grade walls, slabs-on-grade, exterior opaque walls, windows, curtain walls, roofs, and skylights.
 - 2. Contract Drawings:
 - a. Drawings indicate general concepts and design intent for continuity of heat, air and moisture barriers at each exterior building envelope component and at transitions between building envelope components. Coordinate details for continuity based on actual product selections and Contractor's proposed sequence of construction.
- I. Complete Systems:
 - 1. It is the intent of the Contract Documents that all systems, including mechanical and electrical, be complete and functional to provide the intended or specified performance. Provide all incidental items and parts necessary to achieve this requirement.
 - 2. Provide correctly sized power, utilities, piping, drains, services and their connections to equipment and systems requiring them, whether or not specific items are listed in the schedule under "Compatibility of Systems" paragraph in this Section.

- J. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.
 - 1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as University's property.
 - 2. Establish recycling program at job site. Refer to Section 01 74 19 "Construction Waste Management and Disposal" for additional requirements.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
 - 1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
 - b. Coordinate the addition of trade-specific information to the coordination drawings by multiple subcontractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
 - c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
 - e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
 - f. Indicate required installation sequences.
 - g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect/Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:
 - 1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings, where required, to adequately represent the Work.
 - 2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
 - 3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
 - 4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.

- 5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
- 6. Mechanical and Plumbing Work: Show the following:
 - a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
 - b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
 - c. Fire-rated enclosures around ductwork.
- 7. Electrical Work: Show the following:
 - a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
 - b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
 - c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
 - d. Location of pull boxes and junction boxes, dimensioned from column center lines.
- 8. Fire-Protection System: Show the following:
 - a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
- 9. Windows, Curtain Wall, and Exterior Wall Assembly Transition Work: Show all components of each adjacent wall or window system and all required compatible tie-ins between them including transition strips, flashings and sealants. Clearly identify each product, its configuration and its extent. Shop Drawings which only generically indicate adjacent construction and/or indicate "construction by others" will not be acceptable.
- 10. Review: Architect/Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect/Engineer determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect/Engineer will so inform Contractor, who shall make changes as directed and resubmit.
- 11. Coordination Drawing Prints: Prepare coordination drawing prints according to requirements in Section 01 33 00 "Submittal Procedures."
- C. Virtual Design and Construction (VDC), Building Information Model (BIM) and Coordination Digital Data Files:
 - 1. General: It is expected that, to the greatest extent applicable, Contractor will employ VDC and BIM tools to facilitate the construction, coordination, scheduling and phasing of the Work.
 - 2. Contractor's VDC implementation shall include at a minimum the following activities:
 - a. Development and maintenance of a three-dimensional building information model (BIM) of the Work that includes contractor-developed, shop-drawing level information of the following building components and systems:
 - 1) Building structure, including but not limited to, foundations, columns, beams, joists, purlins, floor and roof decking and fill, bracing, and load-bearing walls.
 - 2) HVAC systems, including but not limited to, HVAC piping and pumps, air distribution ductwork, fans, air terminal units, air outlets and inlets; central cooling equipment compressors, chillers, condensers, and cooling towers; boilers, heat exchangers and packaged and/or custom air-handling units and thermal storage systems.

- 3) Plumbing systems, including but not limited to, water distribution, storm drainage and sanitary sewerage waste and vent piping, water-heaters and plumbing fixtures.
- 4) Fire suppression systems, including but not limited to, standpipes, sprinkler systems, fire pumps, and non-water-based fire-extinguishing systems.
- 5) Electrical systems, including but not limited to, conduit greater than 1-1/2 inches in diameter, or bundled conduits, cable-tray, transformers, switchgear, switchboards, panelboards, generators, lightning protection and lighting.
- 6) Communication systems, including but not limited to, structured cabling, premise wiring distribution system, equipment room fittings, racks, frames and enclosures, data communications switches, hubs, and routers, common use systems, and paging systems
- 7) Vertical Transportation systems including.
- 8) Architectural building systems including interior and exterior walls, windows, curtain walls, ceilings, and roof.
- b. Collision Detection Reports: Based on information developed and included in the Contractor's three-dimensional BIM, perform collision/interference checking and develop reports for review and resolution by the integrated Contractor team, including subcontractors, manufacturers and suppliers, working with the Design team where needed prior to release of fabrication drawings.
- 3. Schedule Visualization: Develop and maintain a three-dimension building information model for the expressed purpose of visually demonstrating and communicating proposed project construction schedule and phasing to University, subcontractors and suppliers as applicable. Include all major building systems and construct in such a fashion as to permit animation showing sequential construction of the project based on and driven by the approved Primavera construction schedule.
- 4. Prepare coordination digital data files according to the following requirements:
 - a. File Preparation Format: Same digital data software program, version, and operating system as original Drawings.
 - b. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and Portable Data File (PDF) format.
 - c. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
 - Perform three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect/Engineer.
 - d. Architect/Engineer will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.
 - 1) Architect/Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
 - 2) Digital Data Software Program: Drawings are available in <Insert name and version of digital data software program and operating system>.
 - 3) Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to University and Architect/Engineer.
- 5. Review: At request of Contractor and at Architect/Engineer's discretion, Architect/Engineer will participate in BIM coordination and review meetings and will review coordination model and drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Architect/Engineer determines that the

coordination model and drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Architect/Engineer will inform the Contractor, who shall make changes as directed and resubmit.

D. Interference Resolution: Whenever job measurements and an analysis of the building coordination model, Drawings and Specifications indicate that the various systems cannot be installed without significant deviation from the intent of the Contract, prepare interference drawings as required to indicate conflict between the various systems and other components of the building such as beams, columns, and walls. Include plans, elevations, sections, and other details drawn to large scale as required to clearly define the interference and to indicate the Contractor's proposed solution. Submit interference drawings for review by the Architect prior to proceeding with work in the general areas of the conflict.

1.7 REQUESTS FOR INFORMATION (RFIs)

- A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
 - 1. Architect/Engineer will return RFIs submitted to Architect/Engineer by other entities controlled by Contractor with no response.
 - 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.
- B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
 - 1. Project name.
 - 2. Project number.
 - 3. Date.
 - 4. Name of Contractor.
 - 5. Name of Architect/Engineer.
 - 6. RFI number, numbered sequentially.
 - 7. RFI subject.
 - 8. Specification Section number and title and related paragraphs, as appropriate.
 - 9. Drawing number and detail references, as appropriate.
 - 10. Field dimensions and conditions, as appropriate.
 - 11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - 12. Contractor's signature.
 - 13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
 - 14. Space for response and signature by Architect/Engineer.
- C. RFI Forms: Hard copy form or software-generated form with substantially the same content as indicated above, acceptable to Architect/Engineer.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.

- D. Architect/Engineer's Action: Architect/Engineer will review each RFI, determine action required, and respond. Allow seven calendar days for Architect/Engineer's response for each RFI. RFIs received by Architect/Engineer after 1:00 p.m. will be considered as received the following working day.
 - 1. The following Contractor-generated RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for approval of Contractor's means and methods.
 - d. Requests for coordination information already indicated in the Contract Documents.
 - e. Requests for adjustments in the Contract Time or the Contract Sum.
 - f. Requests for interpretation of Architect/Engineer's actions on submittals.
 - g. Incomplete RFIs or inaccurately prepared RFIs.
 - 2. Architect/Engineer's action may include a request for additional information, in which case Architect/Engineer's time for response will date from time of receipt of additional information.
 - 3. Architect/Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Contractor-Initiated Change Order Bulletin and Proposal according to Section 01 26 00 "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect/Engineer in writing within seven calendar days of receipt of the RFI response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by RFI number. Submit log weekly. Use CSI Log Form 13.2B or Contractor-generated form of substantially same content. Include the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect/Engineer.
 - 4. RFI number including RFIs that were returned without action or withdrawn.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect/Engineer's response was received.
- F. On receipt of Architect/Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect/Engineer within seven calendar days if Contractor disagrees with response.

1.8 PROJECT WEB SITE

- A. Provide, administer, and use Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:
 - 1. Project directory.
 - 2. Project correspondence.
 - 3. Meeting minutes.
 - 4. Contract modifications forms and logs.
 - 5. RFI forms and logs.
 - 6. Submittals forms and logs.
 - 7. Electronic submittal document hosting, viewing and transmitting.
 - 8. Drawing and specification document hosting, viewing, and updating.

- 9. Pay applications.
- 10. Change orders.
- 11. Daily reports.
- 12. Punchlists.
- 13. Archiving functions.
- B. Provide up to twenty-five (25) Project Web site user licenses for use of the University, Architect/Engineer, and Architect/Engineer's consultants. Provide eight hours of software training at Project Site office for Project Web site users.
- C. On completion of Project, provide one each complete archive copy of Project Web site files to University and to Architect/Engineer in a digital storage format acceptable to Architect/Engineer.
- D. Software:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Meridian Systems; Prolog or ProjectTalk under their current published licensing agreements. Comparable software by other software suppliers may be provided if approved in writing at the sole discretion of the Architect/Engineer in consultation with the University Project Manager.
- E. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement acceptable to University and Architect/Engineer.

1.9 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify University and Architect/Engineer of scheduled meeting dates and times a minimum of 4 business days prior to meeting.
 - a. Participants, including representatives of subcontractors and suppliers, shall be qualified, familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including University and Architect/Engineer, within three business days of the meeting.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time and site convenient to all parties, but not later than 14 calendar days after Notice to Proceed.
 - 1. Conduct the conference to review responsibilities and personnel assignments.
 - 2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:
 - a. Authorized representatives of University:
 - 1) University Project Manager.
 - 2) University Building Maintenance Operations (BMO) Representative.

- b. Architect/Engineer and their consultants.
- c. Contractor's project manager and superintendent.
- d. Major subcontractors and suppliers.
- e. Other concerned parties shall attend the conference.
- 3. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Designation of key personnel and their duties.
 - b. Lines of communications.
 - c. List of major subcontractors and suppliers.
 - d. Tentative construction schedule.
 - 1) Phasing.
 - 2) Critical work sequencing and long-lead items.
 - 3) Equipment deliveries and priorities.
 - e. Procedures and processing of:
 - 1) Change Order Bulletin, Change Order Proposal and Change Orders.
 - 2) RFI's
 - 3) Testing and inspecting.
 - 4) Applications for Payment.
 - 5) Submittals.
 - 6) Preparation of record documents.
 - f. Use of the premises, existing building and adjacent buildings as applicable.
 - 1) Work restrictions.
 - 2) Working hours.
 - 3) University's occupancy requirements.
 - 4) Procedures for disruptions and shutdowns.
 - 5) Construction parking and staging.
 - 6) Construction route and site access.
 - 7) Office, work, and storage areas.
 - 8) Progress cleaning and housekeeping procedures.
 - g. Project coordination.
 - h. Distribution of the Contract Documents.
 - i. Temporary facilities and controls.
 - j. Indoor Air Quality Plan and Monitoring including procedures for moisture and mold control.
 - k. Construction waste management and recycling.
 - l. Safety.
 - 1) Fire and Life Safety.
 - 2) Health and Safety.
 - m. First aid.
 - n. Security.
 - o. Building Department.
 - p. Telecommunications.
 - q. Building Services.
 - r. Building Operations.
 - s. University Work Related Policies.
 - t. Contractor Contacts.

- u. University Contacts.
- v. University Process Forms.
 - 1) Key Request Form.
 - 2) Access Control Badge Application Form.
 - 3) Utility Interruption Request Form.
 - 4) Utility Start-Up Form.
 - 5) Fire Alarm/ Sprinkler Disable Request Form.
 - 6) Hot Work Permit Form.
 - 7) Anschutz Medical Campus (AMC) Street and Parking Lot Closure Form.
 - 8) Indoor Air Quality (IAQ) Plan.
 - 9) IAQ Planning Checklist.
 - 10) IAQ Inspection Checklist.
 - 11) Request for Variance.
- 4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site for installations, systems or assemblies where required by individual Specification Sections, or where deemed necessary by Contractor.
 - 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect/Engineer of scheduled meeting dates.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following, as appropriate:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. LEED requirements, for projects pursuing LEED certification.
 - i. Review of mockups.
 - j. Possible conflicts.
 - k. Compatibility requirements.
 - 1. Time schedules.
 - m. Weather limitations.
 - n. Manufacturer's written instructions.
 - o. Warranty requirements.
 - p. Compatibility of materials.
 - q. Acceptability of substrates.
 - r. Temporary facilities and controls.
 - s. Space and access limitations.
 - t. Regulations of authorities having jurisdiction.
 - u. Testing and inspecting requirements.
 - v. Installation procedures.
 - w. Coordination with other work.
 - x. Required performance results.
 - y. Protection of adjacent work.
 - z. Protection of construction and personnel.

- 3. Record significant conference discussions, approved schedules, agreements, and disagreements, including required corrective measures and actions.
- 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information, including University Project Manager and Architect/Engineer.
- 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to University and Architect/Engineer, but no later than 30 calendar days prior to the scheduled date of Substantial Completion or Partial Substantial Completion.
 - 1. Conduct the conference to review requirements and responsibilities related to Project closeout.
 - 2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:
 - a. University Project Manager.
 - b. University Building Maintenance Operations (BMO) Representative.
 - c. Architect/Engineer and their consultants.
 - d. Contractor's project manager and superintendent.
 - e. Major subcontractors and suppliers.
 - f. Other concerned parties.
 - 3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
 - a. Procedures related to:
 - 1) Notice of Completion, including preparation of Contractor's punch list.
 - 2) Final Inspection.
 - 3) Notice of Substantial Completion.
 - 4) Notice of Approval of Occupancy/Use.
 - 5) Supplemental Occupancy/Use Checklist.
 - 6) Supplemental Acceptance Checklist.
 - 7) Pre-acceptance Checklists.
 - 8) Notice of Acceptance.
 - 9) Settlement and Final Payment.
 - b. Preparation of record documents.
 - c. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
 - d. Submittal of written warranties.
 - e. Requirements for preparing operations and maintenance data.
 - f. Requirements for delivery of material samples, attic stock, and spare parts.
 - g. Requirements for demonstration and training.
 - h. University's partial occupancy requirements.
 - i. Installation of University's furniture, fixtures, and equipment.
 - j. Responsibility for removing temporary facilities and controls.
 - 4. Minutes: Entity conducting meeting will record and distribute meeting minutes.
- E. Progress Meetings: Conduct progress meetings at weekly intervals.
 - 1. Coordinate dates of meetings with preparation of payment requests.

- 2. Attendees: Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work and include the following:
 - a. University Project Manager.
 - b. University Health Safety Department Representative.
 - c. University Building Maintenance Operations Representative.
 - d. University Campus Building Official.
 - e. Architect/Engineer and their consultants.
 - f. Contractor's project manager and superintendent.
 - g. Major subcontractors and suppliers.
 - h. Other entities concerned with current progress or involved in planning, coordination, or performance of future activities.
 - i. As needed, University Building Maintenance Operations (BMO), Subject Matter Experts (SME), and University Facility Support Services (FSS) Representatives.
- 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule:
 - 1) Review progress since the last meeting.
 - 2) Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule.
 - 3) Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
 - 4) Review schedule for next two week period.
 - 5) Review schedule of deliveries.
 - 6) Review off-site fabrication.
 - b. Site Safety.
 - c. Indoor Air Quality Management monitoring.
 - d. Quality:
 - 1) Quality and work standards.
 - 2) Status of correction of deficient items.
 - 3) Progress cleaning.
 - 4) Field observations.
 - e. Status of submittals.
 - f. Status of RFIs.
 - g. Status of Changes including:
 - 1) Change Order Bulletins.
 - 2) Change Order Proposals.
 - 3) Change Orders.
 - 4) Pending claims and disputes.
 - h. Review present and future needs of each entity present including:
 - 1) Access.
 - 2) Site utilization.
 - 3) Temporary facilities and controls.

- 4) Coordination.
- 4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
- F. Pay Application and Schedule Review Meeting: Conduct review meeting monthly on or about the 25th of each month.
 - 1. Attendees:
 - a. University Project Manager.
 - b. Architect/Engineer.
 - c. Contractor's Project Manager, Superintendant and Scheduler.
 - 2. Agenda: Review draft pay application and progress schedule update in accordance with the requirements of Section 01 29 00 "Payment Procedures" and Section 01 32 00 "Construction Progress Documentation."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

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SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Startup construction schedule.
 - 2. Contractor's construction schedule.
 - 3. Construction schedule updating reports.
 - 4. Daily construction reports.
 - 5. Monthly project status reports.
 - 6. Material location reports.
 - 7. Site condition reports.
 - 8. Special reports.

B. Related Requirements:

- 1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
- 2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
 - 1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 - 2. Predecessor Activity: An activity that precedes another activity in the network.
 - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum exclusive of profit, overhead, and general conditions costs.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.
- F. Float: The measure of leeway in starting and completing an activity.
 - 1. Float time is not for the exclusive use or benefit of either University or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
 - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Resource Loading: The allocation of manpower necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. Working electronic copy of schedule file, where indicated.
 - 2. PDF electronic file and four paper copies.
- B. Startup construction schedule (bar chart).
 - 1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.
- C. Contractor's Preliminary Schedule and Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Detailed Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
 - 1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.
- E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
 - 3. Total Float Report: List of all activities sorted in ascending order of total float.
 - 4. Earnings Report: Compilation of Contractor's total earnings from commencement of the Work until most recent Application for Payment.
- F. Construction Schedule Updating Reports: Submit draft for discussion at monthly project schedule and pay application review meeting. Submit final report with monthly Application for Payment.

- G. Daily Construction Reports: Submit at weekly intervals.
- H. Material Location Reports: Submit at monthly intervals.
- I. Site Condition Reports: Submit at time of discovery of differing conditions.
- J. Special Reports: Submit at time of unusual event.
- K. Qualification Data: For scheduling consultant or in-house scheduling expert.

1.5 QUALITY ASSURANCE

- A. Scheduling Consultant Qualifications: An experienced specialist in CPM scheduling and reporting, with a minimum of 5 years experience and capability of producing CPM reports and diagrams within 24 hours of Architect/Engineer's request.
- B. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
 - 1. Review software limitations and content and format for reports.
 - 2. Verify availability of qualified personnel needed to develop and update schedule.
 - 3. Discuss constraints, including phasing, work stages, area separations, interim milestones, and partial University occupancy, as may be applicable.
 - 4. Review delivery dates for University-furnished products.
 - 5. Review schedule for work of University's separate contracts.
 - 6. Review submittal requirements and procedures.
 - 7. Review time required for review of submittals and resubmittals.
 - 8. Review requirements for tests and inspections by independent testing and inspecting agencies.
 - 9. Review time required for Project closeout and University startup procedures, including commissioning activities.
 - 10. Review and finalize list of construction activities to be included in schedule.
 - 11. Review procedures for updating schedule.

1.6 COORDINATION

- A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for commencement of the Work to date of Substantial Completion.

- 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date is not permitted. Contract completion date may only be modified by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 21 calendar days, unless specifically allowed by Architect/Engineer.
 - 2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 calendar days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
 - 4. Startup and Testing Time: Include adequate time for startup, testing and commissioning.
 - 5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect/Engineer's administrative procedures necessary for issuing Notice of Substantial Completion.
- C. Constraints: Include the following constraints and work restrictions as indicated in the Contract Documents and as applicable in schedule; show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by University: Include a separate activity for each portion of the Work performed by University.
 - 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 4. University-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Work Restrictions: Show the effect of the following items, as applicable, on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Environmental control.
 - 6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Submittals.
 - b. Mockups.
 - c. Fabrication.
 - d. Sample testing.
 - e. Deliveries.
 - f. Installation.
 - g. Tests and inspections.
 - h. Building flush-out.
 - i. Startup and placement into final use and operation.

- 7. Construction Areas: As applicable, identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Temporary enclosure and space conditioning.
 - c. Permanent space enclosure.
 - d. Completion of mechanical installation.
 - e. Completion of electrical installation.
 - f. Substantial Completion.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Commencement of Work, Substantial Completion, Notice of Occupancy and Use, and Final Acceptance. As applicable, also include milestones for Partial Substantial Completion and Partial Notice of Occupancy and Use.
- E. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.
- F. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules and as approved by University and Architect/Engineer.

2.2 STARTUP CONSTRUCTION SCHEDULE (BAR CHART)

- A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven calendar days of date established for commencement of the Work.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 calendar days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (BAR CHART OR GANTT CHART)

- A. Bar-Chart or Gantt-Chart Schedule: Submit startup, horizontal, bar-chart-type or a comprehensive, fully developed, horizontal, Gantt-chart-type construction schedule within 30 calendar days of date established for commencement of the Work. Base schedule on the startup construction schedule and additional information received since the start of Project.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Use the same breakdown of construction activities as indicated in the Schedule of Values.
 - 1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar. With each required construction schedule update, place a contrasting mark in each bar to indicate actual completion.

2.4 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Contractor's Preliminary Schedule and Startup Network Diagram: Submit diagram within 14 calendar days of date established for commencement of the Work. Outline significant construction activities for the first 90 calendar days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.
- C. CPM Schedule: Prepare Contractor's detailed construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.
 - 1. Develop network diagram and submit CPM schedule within 45 calendar days after date established for commencement of the Work.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect/Engineer's approval of the schedule.
 - 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 - 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 - 4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using contractor's preliminary schedule and startup network diagram, prepare a skeleton network to identify probable critical paths.
 - 1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by University that may affect or be affected by Contractor's activities.
 - i. Testing and commissioning.
 - j. Punch list and final completion.
 - k. Activities occurring following final completion.
 - 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 - 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 - 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.
 - a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

- 5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Assign activities and costs for mobilization, bonds, permits and insurance. Obtain Architect/Engineer's approval prior to assigning costs to material procurement activities if intending to bill for materials stored on site. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, LEED documentation, and demonstration and training (if applicable), in the amount of not more than 5 percent of the Contract Sum.
 - a. Each activity cost shall reflect an appropriate value subject to approval by Architect/Engineer.
 - b. Total cost assigned to activities shall equal the total Contract Sum exclusive of general conditions, overhead and profit costs.
 - c. As requested by University, code activities to permit sorting of Schedule of Values by CSI Division, funding sources, sub-trades, building systems, Bid Packages as applicable, or combinations thereof.
 - d. Resource load activities with forecasted manpower and code to permit production of graphically depicted manpower report. Show manpower effort for each subcontractor and as an aggregate for each month.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.
- H. Summary Reports: With each schedule update, at a minimum provide the following hard copy cost and resource reports:
 - 1. Cost report showing activity dollar value, dollar value of work in place to-date and dollar value for current period.
 - 2. Cost report showing activity dollar value, dollar value of work in place to-date, and dollar value for current period summarizing to schedule of values.

- 3. Resource report showing man-day allocations by specific trade on each activity.
- 4. Variance report comparing current dates to target dates.
- 5. Cash flow report showing monthly projections of expenditures.
- 6. Narrative schedule report documenting:
 - a. Description of the actual work accomplished during the reporting period.
 - b. Description of any problem areas.
 - c. Description of current and anticipated delays with recommended corrective actions to mitigate such delays.
 - d. A list of proposed modifications, additions, deletions, and changes in logic to the approved construction schedule.

2.5 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Accidents.
 - 8. Meetings and significant decisions.
 - 9. Unusual events (see special reports).
 - 10. Stoppages, delays, shortages, and losses.
 - 11. Meter readings and similar recordings.
 - 12. Emergency procedures.
 - 13. Orders and requests of authorities having jurisdiction.
 - 14. Change Orders received and implemented.
 - 15. Services connected and disconnected.
 - 16. Equipment or system tests and startups.
 - 17. Partial completions and occupancies.
 - 18. Substantial Completions authorized.
- B. Monthly Project Status Report: Prepare a monthly project status report including the following:
 - 1. Current status of Project:
 - a. Schedule.
 - b. Cost.
 - c. MBE and WBE participation, as applicable.
 - d. RFI's.
 - e. Submittals.
 - f. Manpower.
 - g. Safety.
 - 2. Narrative of progress achieved in previous month, activities anticipated for the next month, and issues affecting the rate of progress.
 - 3. Progress photographs in accordance with Section 01 32 33 "Photographic Documentation."
- C. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials

or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

- 1. Material stored prior to previous report and remaining in storage.
- 2. Material stored prior to previous report and since removed from storage and installed.
- 3. Material stored following previous report and remaining in storage.
- D. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.6 SPECIAL REPORTS

- A. General: Submit special reports directly to University within one calendar day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise University in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Scheduling Consultant: Engage a consultant to provide planning, evaluation, and reporting using CPM scheduling.
 - 1. In-House Option: University may waive the requirement to retain a consultant if Contractor employs skilled personnel with experience in CPM scheduling and reporting techniques. Submit qualifications.
 - 2. Meetings: Scheduling consultant shall attend all meetings related to Project progress, alleged delays, and time impact.
- B. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule draft update schedule for discussion and review at monthly project progress schedule and pay application review meeting.
 - 1. Revise schedule immediately after each meeting and issue updated schedule concurrently with submittal of monthly Application for Payment.
 - 2. Include summary reports with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate final completion percentage for each activity.
 - 4. Schedule updates may change logic but may not change milestone or critical path without prior approval of University and Architect/Engineer.
- C. Distribution: Distribute copies of approved schedule to Architect/Engineer University, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.

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

END OF SECTION 01 32 00

SECTION 01 32 33

PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
 - 3. Final completion construction photographs.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.
 - 2. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For photographer.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files within three business days of taking photographs.
 - 1. Digital Camera: Minimum sensor resolution of 12 megapixels.
 - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped, in folder named by date of photograph, accompanied by key plan file.
 - 3. Identification: Provide the following information with each image description in file metadata tag:
 - a. Name of Project.
 - b. Name and contact information for photographer.
 - c. Name of Architect/Engineer.
 - d. Name of Contractor.
 - e. Date photograph was taken.
 - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
 - g. Unique sequential identifier keyed to accompanying key plan.

1.4 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to University for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. Photographer: Engage a qualified photographer to take construction photographs.
- B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- C. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in file name for each image.
 - 2. Field Office Images: Maintain one set of images accessible in the field office at Project site, available at all times for reference. Identify images in the same manner as those submitted to Architect/Engineer.
- D. Preconstruction Photographs: Before starting construction, take photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Architect/Engineer.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take 20 photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take 20 photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- E. Periodic Construction Photographs: Take 20 photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
- F. Architect/Engineer-Directed Construction Photographs: From time to time, Architect/Engineer will instruct photographer about number and frequency of photographs and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.
- G. Final Completion Construction Photographs: Take 20 color photographs after date of Substantial Completion for submission as project record documents. Architect/Engineer will inform photographer of desired vantage points.
 - 1. Do not include date stamp.
- H. Additional Photographs: University through Architect/Engineer may request photographs in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum.
 - 1. Three business days' notice will be given, where feasible.
 - 2. In emergency situations, take additional photographs within 24 hours of request.
 - 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. University's request for special publicity photographs.

END OF SECTION 01 32 33

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SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Requirements:
 - 1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
 - 2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
 - 3. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Division 02 through 33 for additional submittal requirements specific to indicated Specification Sections.

1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect/Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals." Submittals not specifically indicated as informational submittals are considered to be action submittals.
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect/Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals" and include, but are not limited to:
 - 1. Schedules.
 - 2. Permits.
 - 3. Applications for payment.
 - 4. Performance and payment bonds.
 - 5. Insurance certificates.
 - 6. List of Subcontractors.
 - 7. Schedule of Values.
 - 8. Inspection and test results.

- 9. Closeout documents.
- 10. Coordination drawings.
- 11. Street and Storm Water Quality Management Plan.
- 12. Indoor Air Quality Management Plan.
- 13. Anschutz Medical Campus Street Services Request.
- C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

- A. Submittals: Refer to individual CSI divisions for additional submittal requirements. If CSI division submittal requirements does not fully cover project scope, contractor shall submittal product data, shop drawings, testing data, certifications, and additional information for all permanent materials and components.
- B. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect/Engineer and additional time for handling and reviewing submittals required by those corrections.
 - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
 - 2. Initial Submittal: Submit concurrently with startup construction schedule and within 30 calendar days of Notice to Proceed or Commencement of Work, but not later than submittal of first application for payment. Include submittals required during the first 90 calendar days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
 - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
 - a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.
 - 4. Format: Arrange the following information in a tabular format:
 - a. Scheduled date for first submittal.
 - b. Specification Section number and title.
 - c. Submittal category: Action; informational.
 - d. Name of subcontractor.
 - e. Description of the Work covered.
 - f. Scheduled date for resubmittal.
 - g. Scheduled date for Architect/Engineer's final release or approval.
 - h. Scheduled date of fabrication.
 - i. Scheduled dates for purchasing.
 - j. Scheduled dates for installation.
 - k. Activity or event numbers.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

- A. Architect/Engineer's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect/Engineer for Contractor's use in preparing submittals.
 - 1. Architect/Engineer will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings.
 - a. Architect/Engineer makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
 - b. Contractor shall execute a data licensing agreement in the form of the "Agreement for Use of Digital Data" included in the Project Manual following this Section or other form acceptable to University and Architect/Engineer.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit for review with sufficient time to avoid construction delays.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
 - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect/Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect/Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
 - 1. Initial Review: Allow 14 calendar days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect/Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
 - 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 - 3. Resubmittal Review: Allow 14 calendar days for review of each resubmittal.
 - 4. Large and/or Complex Submittals: For large and/or complex submittals, as determined by the Architect/Engineer and for submittals that require sequential reviews by Architect/Engineer's consultants, a review period greater than 14 calendar days may be required. Architect/Engineer and Contractor shall identify such submittals upon submission of the submittal schedule and determine a mutually agreed upon review period.
- D. Paper Submittals: Place a permanent label or title block on each submittal item for identification.
 - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
 - 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Architect/Engineer.
 - 3. Include the following information for processing and recording action taken:
 - a. Project name.
 - b. Date.

- c. Name of Architect/Engineer.
- d. Name and address of Contractor.
- e. Name and address of subcontractor.
- f. Name and address of supplier.
- g. Name of manufacturer.
- h. Submittal number or other unique identifier, including revision identifier.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 061000.01.A).
- i. Number and title of appropriate Specification Section.
- j. Drawing number and detail references, as appropriate.
- k. Location(s) where product is to be installed, as appropriate.
- l. Other necessary identification.
- 4. Additional Paper Copies: Unless additional copies are required for final submittal, and unless Architect/Engineer observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
 - a. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Architect/Engineer.
- 5. Transmittal for Paper Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect/Engineer will return without review submittals received from sources other than Contractor.
 - a. Transmittal Form for Paper Submittals: Provide locations on form for the following information:
 - 1) Project name.
 - 2) Date.
 - 3) Destination (To:).
 - 4) Source (From:).
 - 5) Name and address of Architect/Engineer.
 - 6) Name and address of Contractor.
 - 7) Name of firm or entity that prepared submittal.
 - 8) Names of subcontractor, manufacturer, and supplier.
 - 9) Category and type of submittal.
 - 10) Submittal purpose and description.
 - 11) Specification Section number and title.
 - 12) Specification paragraph number or drawing designation and generic name for each of multiple items.
 - 13) Drawing number and detail references, as appropriate.
 - 14) Indication of full or partial submittal.
 - 15) Transmittal number.
 - 16) Submittal and transmittal distribution record.
 - 17) Remarks.
 - 18) Contractor's certification that information complies with Contract Document requirements.
 - 19) Signature of transmitter.
- E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

- 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
- 2. Name file with submittal number or other unique identifier, including revision identifier.
 - a. File name shall use project identifier and Specification Section number followed by a dash and then a sequential number (e.g., LNHS-061000-01). Resubmittals shall include an alphabetic suffix after another dash (e.g., LNHS-061000-01-A).
- 3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect/Engineer.
- 4. Transmittal Form for Electronic Submittals: Use software-generated form from electronic project management software acceptable to University, containing the following information:
 - a. Project name.
 - b. Date.
 - c. Name and address of Architect/Engineer.
 - d. Name and address of Contractor.
 - e. Name of firm or entity that prepared submittal.
 - f. Names of subcontractor, manufacturer, and supplier.
 - g. Category and type of submittal.
 - h. Submittal purpose and description.
 - i. Specification Section number and title.
 - j. Specification paragraph number or drawing designation and generic name for each of multiple items.
 - k. Drawing number and detail references, as appropriate.
 - 1. Location(s) where product is to be installed, as appropriate.
 - m. Related physical samples submitted directly.
 - n. Indication of full or partial submittal.
 - o. Transmittal number.
 - p. Submittal and transmittal distribution record.
 - q. Other necessary identification.
 - r. Contractor's certification that information complies with Contract Document requirements.
 - s. Remarks.
- F. Options: Identify options requiring selection by Architect/Engineer.
- G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect/Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- H. Contractor Certification: On transmittal include Contractor's certification that information complies with Contract Document requirements.
- I. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
 - 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked with approval notation from Architect/Engineer's action stamp.
- J. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

- K. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect/Engineer's action stamp.
- L. Record Documents: Retain complete additional copies of submittals on Project site to be submitted as record documents in accordance with requirements of Section 01 78 39 "Project Record Documents."
- M. Legibility: Provide clear and legible submittals. Submittals that are blurry or are for any reason unreadable will be returned without action.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

- A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
 - 1. Post electronic submittals as PDF electronic files directly to Project Management Software Web site specifically established for Project.
 - a. Architect/Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
 - 2. Action Submittals: Submit three paper copies of each submittal to Architect/Engineer and one to University unless otherwise indicated. Architect/Engineer will return one copy.
 - 3. Informational Submittals: Submit two paper copies of each submittal to Architect/Engineer and one to University unless otherwise indicated. Architect/Engineer will not return copies.
 - 4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 - 1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Manufacturer's printed recommendations.
 - e. Standard color charts.
 - f. Statement of compliance with specified referenced standards.
 - g. Statement of compliance with specified trade association standards.
 - h. Testing by recognized testing agency.
 - i. Application of testing agency labels and seals.
 - j. Notation of coordination requirements.
 - k. Notation of dimensions verified by field measurement.
 - 4. For equipment, include the following in addition to the above, as applicable:

- a. Wiring diagrams showing factory-installed wiring.
- b. Printed performance curves.
- c. Operational range diagrams.
- d. Rough-in diagrams and templates indicating clearances required to other construction, if not indicated on accompanying Shop Drawings.
- 5. Submit Product Data before or concurrent with Samples.
- 6. Confirm compliance of Product Data with requirements of Contract Documents. Submit cover letter indicating Contractor's certification of compliance.
- 7. Submit additional copies of Product Data as required complying with requirements of Section 01 78 39 "Project Record Documents."
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Highlight, encircle or otherwise indicate deviations from Contract Documents. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Architect/Engineer's digital data drawing files is otherwise permitted. Standard information prepared without specific reference to the Project is not considered a shop drawing.
 - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than size of Construction Drawings.
 - 3. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
 - a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
 - b. Refer to Section 01 31 00 "Project Management and Coordination" for requirements for coordination drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
 - 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Mount, display or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect/Engineer's Sample.
 - 3. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of applicable Specification Section.
 - e. Specification paragraph number and generic name of each item.

- f. Compliance with recognized standards.
- g. Availability and delivery time.
- 4. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
- 5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect/Engineer will return submittal with options selected.
- 6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit three sets of Samples. Architect/Engineer will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- 7. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as University's property, are the property of Contractor.
- 8. Distribution of Samples: Prepare and distribute additional sets to Subcontractors, manufacturers, fabricators, suppliers, Installers, and others as required for performance of the Work. Show distribution on transmittal forms.
- 9. Field Samples and Mock-Ups: Field Samples and mock-ups specified in individual Sections are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
- E. Selection of Related Materials: Where selections of colors, patterns, textures are specified to be made by Architect/Engineer, assemble complete samples of all specified or approved products for all Specification Sections and submit to Architect/Engineer. Review specifications and assemble all such samples for a combined single submittal. Indicate on the transmittal the latest date for selections to be made for each item to permit delivery of material in accordance with Progress Schedule. Architect/Engineer's action is limited solely to the specified selections or rejection of submittal items not in accordance with Specifications.

- F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."
- G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."
- H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."
- I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."
- J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."
- K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."
- L. LEED Submittals: For project required to obtain LEED certification, comply with requirements specified in Division 01 Section "Sustainable Design Requirements".
- M. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- N. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- O. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- P. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- Q. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- R. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- S. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- T. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

- U. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - 1. Name of evaluation organization.
 - 2. Date of evaluation.
 - 3. Time period when report is in effect.
 - 4. Product and manufacturers' names.
 - 5. Description of product.
 - 6. Test procedures and results.
 - 7. Limitations of use.
- V. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- W. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- X. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- Y. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect/Engineer.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.
 - 1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect/Engineer. Submittals received without Contractor's substantive review and approval stamp will be rejected and returned to the Contractor.
- B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."
- C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT/ENGINEER'S ACTION

- A. Action Submittals: Architect/Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect/Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Architect/Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect/Engineer will forward each submittal to appropriate party.
- C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect/Engineer.
- D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
- E. Submittals not required by the Contract Documents may be returned by the Architect/Engineer without action.

END OF SECTION 01 33 00

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DIGITAL INFORMATION RELEASE AGREEMENT

hord coplan macht

Date:
Project:
Project No:

The undersigned has requested access to design materials and related information, including Revit models or other digital models (the "Materials") in electronic format which were prepared by, or in the process of being prepared by, Hord Coplan Macht, Inc. (HCM) concerning the above referenced Project(s). The undersigned seeks access to the Materials for pricing and constructability review, and other uses. HCM is willing to permit access and use of the Materials, which access is expressly conditioned upon the following conditions.

Accordingly, the undersigned understands, acknowledges, and agrees:

- 1. That the Materials are prepared and stored on a computer system that may be vulnerable to latent defects, deficiencies, computer "viruses" and hidden software that could cause damage to the undersigned's own computer systems and business information.
- 2. The Materials comprise digital information which may be changed after the undersigned's receipt of the Materials. Electronic data, such as the Materials, stored on electronic media can deteriorate undetected and may be modified or altered without the knowledge of the undersigned or HCM. Further, HCM is under no obligation to correct, modify or update the Materials or to notify the undersigned of any need to correct, modify, or update the Materials.
- 3. The Materials may not be verified as compliant with all authorities having jurisdiction over the Project, and may be incomplete, may contain errors, and otherwise may not represent an accurate set of Materials required for the Project. Accordingly, the use of the Materials is wholly at the risk of the undersigned. Further, the use of Materials shall not in any way obviate the undersigned's responsibility for the proper checking and coordination of built conditions, dimensions, details, materials, sizes and quantities as required to facilitate complete and accurate pricing, fabrication and erection.
- 4. The Materials were generated utilizing commercial software (e.g. AutoCad, Revit) under license to HCM, and HCM is under no obligation to provide any software or hardware required to read and manipulate said information. HCM is also under no obligation to provide supplemental files, and linked data (e.g. font files, line types, or external references). The digital files to be provided for this project will be in ______ format as requested and as prepared by HCM.
- 5. The undersigned acknowledges the Materials are the property of HCM and its consultants or may be governed by HCM's contract concerning the Project. Accordingly, HCM neither owns nor controls the release of our consultants' digital files (i.e. MEP, structural, civil, etc.). This agreement does not constitute a transfer of ownership or copyright in the Materials or transfer or relinquishment of any rights to the intellectual properties contained in the Materials.
- 6. It is the sole discretion of HCM to determine the scope of any Materials which it may release and any costs for the same. The undersigned may use the documents and design only for the projects where HCM is the Architect for the above referenced project and only with our express written permission.

hord | coplan | macht

- 7. The undersigned agrees to indemnify, defend, release, and hold HCM, their consultants, and the Owner harmless from any responsibility or obligation as to the accuracy or completeness of the Materials and further waives any claim it may have for expenses, including but not limited to attorney's fees, resulting from the undersigned relying upon or utilizing the Materials.
- 8. The Materials are provided for the exclusive use of the personnel of the undersigned ONLY. The information will not be transferred by the undersigned for use by others.
- 9. The undersigned confirms that it will use the Materials solely with respect to the Project and shall not use, copy, or distribute the Materials for any other project or purpose. The undersigned shall require each individual user of the Materials, to the extent of the work to be performed by such user, to be bound by the terms and conditions of this Agreement, and to assume toward the undersigned all the obligations and responsibilities that the undersigned, by this Agreement, assumes toward HCM.
- 10. The undersigned acknowledges and agrees that in the event of a breach or threatened breach of this Agreement by the undersigned or any of its employees or agents, HCM or its consultants may suffer irreparable harm and therefore HCM will be entitled to seek injunctive relief to enforce this Agreement, in addition to any other legal remedies available to them. The undersigned expressly agrees that HCM shall be entitled to collect from the undersigned any reasonable attorneys' fees or costs incurred by HCM to enforce this Agreement or any provision herein.

The above shall constitute the entire agreement between Hord Coplan Macht, Inc, and the undersigned for providing the undersigned permission to access and utilize the Materials for any and all purposes.

THIS AGREEMENT ACCEPTED BT.	
Company: Hord Coplan Macht, Inc.	Company:
Name:	Name:
Title:	Title:
Signature:	Signature:

SECTION 01 35 44

SPECIAL PROCEDURES FOR ENVIRONMENTAL HEALTH AND SAFETY AND FIRE AND LIFE SAFETY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes special administrative and procedural requirements related to environmental health and safety.
- B. University is Authority Having Jurisdiction (AHJ) for Fire and Life Safety. This responsibility is administered by the University's Fire and Life Safety Officer.
- C. Related Requirements:
 - 1. Section 01 35 46 "Indoor Air Quality Procedures" for procedure related to maintaining indoor air quality during construction.
 - 2. Section 02 81 00 "Transportation/Disposal of Hazardous Materials."

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 ENVIRONMENTAL HEALTH AND SAFETY AND FIRE AND LIFE SAFETY PROCEDURES

- A. Physical, Life, and Fire Safety:
 - 1. All contractors are required to conform to the Federal Occupational Safety and Health Administration (OSHA) regulations for construction (29 CFR 1926). Certain General Industry Standards (29 CFR 1910) may also apply, depending on location of work.
 - 2. Provide an effective health and safety program to control hazards, including but not limited to compressed gases, welding, electrical, safety netting, cranes, scaffolding and supplies on the roof.
 - 3. Provide fire protection in all construction areas to the satisfaction of the Authority Having Jurisdiction.
 - 4. During the construction phase, the Authority Having Jurisdiction may conduct oversight inspections to observe and provide recommendations regarding applicable safety standards. The following minimum items are included:
 - a. Do not block exit corridors. Install signage clearly identifying exit routes.

- b. Provide physical barriers with appropriate warning signage to protect public areas from construction work.
- c. Conduct daily inspections to eliminate fire hazards and any other safety hazards.
- d. Periodic safety inspections will be performed on job sites by the Authority Having Jurisdiction. The Authority Having Jurisdiction for fire safety will present University's Project Manager with a written summary of the findings who will then take these issues to the Contractor's superintendent, foreman or other designated representative and return the summary form with documentation of the resolution of safety items to AHJ. Abate deficient items in a timely manner. Include documentation and resolution of safety items presented in weekly Progress Meeting minutes. Inspections by University AHJ are spot-checks only. They are not all encompassing. These inspections and recommendations do not relieve the Contractor from obligations related to safe work practices, as required under federal law.
- e. AHJ has the right to access the site at all times. Should a potential threat to personnel or property be observed, AHJ may require the hazard related operation immediately altered until adequate safeguards are addressed.
- f. Supply AHJ, through the University Project Manager, with a copy of Contractor's weekly safety meeting minutes and safety inspection reports.
- g. Provide signs used for proper identification of construction areas.
- h. Provide adequate number of appropriately rated fire extinguishers to be available on-site for emergency use in the construction area.
- i. Insure standpipes, pull stations, electrical panels, water control valves and fire hydrants are accessible at all times.
- j. Post emergency notification phone numbers provided by Contractor and University in all construction areas.
- k. Notify University Project Manager of any lost time injuries occurring on University's property within one (1) calendar day and of any fatalities immediately.
- 1. Submit copies of all injury reports to AHJ, through University's Project Manager.
- m. Equip construction personnel with personal protective equipment (PPE) where required. Coordinate with University Project Manager to identify where use of PPE will be required.
- B. OSHA Hazard Communication Standard:
 - 1. Every Contractor and Subcontractor performing work shall to comply with the OSHA Hazard Communication Standard. Compliance includes joint University and Contractor responsibilities for the purpose of providing timely communications and information sharing with regard to hazardous materials, chemicals and chemical sources which may be present on-site or brought in by Contractor.
 - 2. University Project Manager will provide Contractor with the following:
 - a. Information regarding known hazardous chemicals and agents or other hazards present at the job site.
 - b. University emergency procedures and contact numbers.
 - 3. Provide safety training and environmental surveillance of all workers.
 - 4. Inform and provide University's Project Manager the following:
 - a. Material safety data sheets (MSDS) for all chemicals introduced into the workplace.
 - b. Information regarding potential sources of pollutants which may be entrained in University's air intakes, e.g., roofing tar fumes, nuisance dusts, exhaust from internal combustion engines, welding or cutting fumes, and asbestos if damaged or encountered during the course of the work.
- C. Asbestos and Lead Paint:

- 1. The presence of asbestos-containing materials and/or paint containing lead on the job site does not mean a problem exists. Areas where asbestos is friable and not contained or lead paint is present or will be caused to be present in airborne or settled dust are of concern.
- 2. Responsibilities of University and Contractor regarding asbestos and lead paint are as follows:
 - a. University:
 - Notify the Contractor of the condition and location(s) where asbestos is known to be present or may reasonably be encountered, e.g., asbestos insulation, ceiling tiles, floor tiles, fire doors, wall and ceiling plasters, concrete, grouting, etc., and lead paint on metal building materials, walls, windows, etc.
 - 2) Coordinate with Contractor when response action is required by a Subcontractor.
 - 3) Contract with third party contractor to monitor areas where friable asbestos and/or lead-containing particles are present during construction/renovation projects for its own records and purpose. Monitoring results can be shared with Contractors but are in no way to be used for Contractor employee monitoring.
 - 4) Final authority on all asbestos-related concerns and contractual arrangements.
 - b. Contractor:
 - 1) Notify University's Project Manager of any suspected or existing problem involving asbestos or lead and cease work in that area until University has assessed the situation.
 - 2) Ensure that undamaged asbestos-containing material and/or material containing lead, not included in the scope of the project, are not damaged.
 - 3) Train and monitor their own employees, including Asbestos Awareness training and Lead Paint Awareness training, where applicable.
 - 4) Be responsible for all environmental/industrial hygiene surveillance of its work staff and subcontractors and for required area monitoring where potential contamination of adjacent areas exists.
 - 5) Prevent problems which can result in asbestos or lead exposure to building occupants.
 - 6) Coordinate with the University's EHS Department and Building Maintenance and Operations through University's Project Manager and perform all activities that may potentially disturb asbestos containing materials in a manner acceptable to the EHS.
 - Follow State of Colorado regulation, Emission Standards for Asbestos, Part B, Control of Asbestos, "Regulation 8" and OSHA standards regulating exposure to asbestos and lead.
 - 8) Where applicable, comply with Section 02 81 00 "Transportation/Disposal of Hazardous Materials."
 - 9) Comply with current "Asbestos-Contaminated Soil Management Standard Operating Procedure Document, University of Colorado Anschutz Medical Campus" during excavation operations.

D. Carcinogens:

- 1. Contractor or any Subcontractor shall not knowingly install or cause to be installed any material or product containing carcinogens. Refer to Annual Report on Carcinogens, U.S. Department of Health and Human Services, National toxicology Program.
- E. Hazardous Waste:
 - 1. All hazardous wastes are to be handled and disposed of according to current EPA and CDPHE guidelines which can be obtained through University Project Manager. Only individuals specifically authorized by University may sign hazardous waste manifests for wastes generated on

University's property. Only University approved transporters and disposal facilities are to be used for transportation and disposal of hazardous wastes.

- F. The Control of Hazardous Energy (Lockout/Tagout):
 - 1. Provide and enforce a program and procedures for the control of hazardous energy (lockout/tagout) including, but not limited to, locks, tags and lockout devices. Provide proof that workers have received safety training in the control of hazardous energy through lockout/tagout.
- G. Hot Work Operations:
 - 1. Comply with University hot work policy and obtain Hot Work Permit prior to executing any hot work in existing buildings.
 - 2. Notify University Project Manager prior to any hot work on University property.
 - 3. Provide and enforce a program to control fires during hot work operations. Provide appropriately rated fire extinguishers, fire retardant protective covers (when needed), and any other hot work related equipment.
- H. Confined Space Entry:
 - 1. Work in compliance with the "Confined Spaced Entry Procedure for Non-University Personnel" whenever any project requires entry into a confined space. A copy of this procedure can be obtained from University EHS through University's Project Manager.
- I. Green Tagging of Work Area:
 - 1. Obtain a Green Tag and Construction Permit from the University Project Manager prior to any work being conducted in a laboratory or on any exhaust ductwork system serving a laboratory. If a Green Tag has been issued, it will be displayed at the entry of the laboratory area. The Green Tag assures that any radioactive, chemical or biological materials have been removed from the laboratory verifying the area is free from hazards to workers. If a Green Tag is not displayed, coordinate tagging with EHS through University's Project Manager.
- J. Coronavirus / COVID-19
 - 1. Work in compliance with all current regulatory guidelines, CU Denver | Anschutz Medical Campus COVID-19 plan requirements, and university contractor COVID-19 plan requirements.
 - 2. Contact the university project manager for the current COVID-19 contractor plan. Contractor to return a completed university COVID-19 contractor plan along with a company COVID-19 plan.
 - 3. Contractor must receive plan acceptance from project manager prior to being granted access to the campus.
 - 4. Plan requirements are evolving, the university project manager will provide additional updates as necessary.

END OF SECTION 01 35 44

SECTION 01 35 46

INDOOR AIR QUALITY PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes administrative and procedural requirements for managing emissions and moisture control during construction.

1.3 DEFINITIONS

- A. Sustainable Design Related Terminology: As defined is ASTM E 2114.
- B. Adequate Ventilation: Ventilation, including air circulation and air changes, required to cure materials, dissipate humidity, and prevent accumulation of particulates, dust, fumes, vapors, or gases.
- C. Hazardous Materials: Any material that is regulated as a hazardous material in accordance with 49 CFR 173, requires a Material Safety Data Sheet (MSDS) in accordance with 29 CFR 1910.1200, or which during end use, treatment, handling, storage, transportation or disposal meets or has components which meet or have the potential to meet the definition of a Hazardous Waste in accordance with 40 CFR 261. Throughout this specification, hazardous material includes hazardous chemicals.
 - 1. Hazardous materials include: pesticides, biocides, and carcinogens as listed by recognized authorities, such as the Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC).
- D. Indoor Air Quality (IAQ): The composition and characteristics of the air in an enclosed space that affect the occupants of that space. The indoor air quality of a space refers to the relative quality of air in a building with respect to contaminants and hazards and is determined by the level of indoor air pollution and other characteristics of the air, including those that impact thermal comfort such as air temperature, relative humidity and air speed.
- E. Interior Final Finishes: Materials and products that will be exposed at interior, occupied spaces including but not limited to flooring, wallcovering, finish carpentry, and ceilings.
- F. Packaged Dry Products: Materials and products that are installed in dry form and are delivered to the site in manufacturer's packaging including but not limited to carpets, resilient flooring, ceiling tiles, and insulation.
- G. Wet Products: Materials and products installed in wet form, including paints, sealants, adhesives, special coatings, and other materials which require curing.

1.4 QUALITY ASSURANCE

A. Inspection and Testing Lab Qualifications: Minimum of 5 years experience in performing the types of testing specified herein.

1.5 PRECONSTRUCTION MEETING

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with University and Architect/Engineer to review and discuss the proposed IAQ Management Plan and develop a mutual understanding of detailed requirements for maintaining indoor air quality and environmental protection.

1.6 SUBMITTALS

- A. Indoor Air Quality (IAQ) Management Plan: Not less than 10 business days before the Pre-construction meeting, prepare and submit an IAQ Management Plan including, but not limited to, the following:
 - 1. Procedures for control of emissions during construction.
 - a. Identify schedule for application of interior finishes.
 - 2. Procedures for moisture control during construction.
 - a. Identify porous materials and absorptive materials.
 - b. Identify schedule for inspection of stored and installed absorptive materials.
 - 3. Revise and resubmit Plan as required by University.
 - a. Approval of Contractor's Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations.

B. Product Data:

- 1. Submit product data for filtration media used during construction and during operation. Include Minimum Efficiency Reporting Value (MERV).
- 2. Submit air pressure difference maps for each mode of operation of HVAC.
- 3. Material Safety Data Sheets: Submit MSDSs for inclusion in Operation and Maintenance Manual for the following products. Coordinate with Section 01 78 23 Operation and Maintenance Data.
 - a. Adhesives.
 - b. Floor and wall patching/leveling materials.
 - c. Caulking and sealants.
 - d. Insulating materials.
 - e. Fireproofing and firestopping.
 - f. Carpet.
 - g. Paint.
 - h. Clear finish for wood surfaces.
 - i. Lubricants.
 - j. Cleaning products.
- C. Inspection and Test Reports:

- 1. Moisture control inspections.
- 2. Moisture content testing.
- 3. Moisture penetration testing.
- 4. Microbial growth testing.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 IAQ MANAGEMENT - EMISSIONS CONTROL

- A. Provide point person responsible for the implementation and assurance that the Indoor Air Quality Plan is being implemented.
- B. University Indoor Air Quality Plan: Comply with the requirements of the University IAQ Plan, latest version, appended to this Specification Section.
- C. Flush-Out: After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

3.2 IAQ MANAGEMENT - MOISTURE CONTROL

- A. Housekeeping:
 - 1. Keep materials dry. Protect stored on-site and installed absorptive materials from moisture damage.
 - 2. Verify that installed materials and products are dry prior to sealing and weatherproofing the building envelope.
 - 3. Install interior absorptive materials only after building envelope is sealed and weatherproofed.
- B. Inspections: Document and report results of inspections; state whether or not inspections indicate satisfactory conditions.
 - 1. Examine materials for dampness as they arrive. If acceptable to University, dry damp materials completely prior to installation; otherwise, reject materials that arrive damp.
 - 2. Examine materials for mold as they arrive and reject materials that arrive contaminated with mold.
 - 3. Inspect stored and installed absorptive materials regularly for dampness and mold growth. Inspect weekly.
 - a. Where stored on-site or installed absorptive materials become wet, notify Architect/Engineer and University. Inspect for damage. If acceptable to University, dry completely prior to closing in assemblies; otherwise, remove and replace with new materials.
 - 4. Basement: Monitor basement and crawlspace humidity, and dehumidify when relative humidity is greater than 85 percent for more than 2 weeks or at the first sign of mold growth.
 - 5. Site drainage: Verify that final grades of site work and landscaping drain surface water and ground water away from the building.

- 6. Weather-proofing: Inspect moisture control materials as they are being installed. Include the following:
 - a. Air and weather-resistive barrier: Verify air and weather-resistive barrier is installed without punctures and/or other damage. Verify air barrier and weather-resistive is sealed completely.
 - b. Flashing: Verify correct shingling of the flashing for roof, walls, windows, doors, and other penetrations.
 - c. Insulation layer: Verify insulation is installed without voids.
 - d. Roofing: In accordance with ASTM D7186 Standard Practice for Quality Assurance Observation of Roof Construction and Repair
- 7. Plumbing: Verify satisfactory pressure test of pipes and drains is performed before closing in and insulating lines.
- 8. HVAC: Inspect HVAC system as specified in Section 23 08 00 Commissioning.
 - a. And, inspect HVAC to verify:
 - 1) Condensate pans are sloped and plumbed correctly.
 - 2) Access panels are installed to allow for inspection and cleaning of coils and ductwork downstream of coils.
 - 3) Ductwork and return plenums are air sealed.
 - 4) Duct insulation is installed and sealed.
 - 5) Chilled water line and refrigerant line insulation are installed and sealed.
- C. Schedule:
 - 1. Schedule work such that absorptive materials, including but not limited to porous insulations, paper-faced gypsum board, ceiling tile, and finish flooring, are not installed until they can be protected from rain and construction-related water.
 - 2. Weather-proof as quickly as possible. Schedule installation of moisture-control materials, including but not limited to air and weather-resistive barriers, flashing, exterior sealants and roofing, at the earliest possible time.
- D. Testing for Moisture Content: Test moisture content of porous materials and absorptive materials to ensure that they are dry before sealing them into an assembly. Document and report results of testing. Where tests are not satisfactory, dry materials and retest. If satisfactory results cannot be obtained with retest, remove and replace with new materials.
 - 1. Concrete: Moisture test prior to finish flooring application as specified in Division 09.
 - 2. Wood: Moisture test as per ASTM D4444 Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters; unless otherwise indicated acceptable upper limits for wood products are < 20% at center of piece; < 15% at surface.
 - 3. Gypsum Board, Gypsum Plaster, Insulation, and other absorptive materials: Moisture test with a Pinless Moisture Meter to assess patterns of moisture, if any.
- E. Testing for Support of Microbial Growth: Test and report in accordance with ASTM D6329 Standard Guide for Developing Methodology for Evaluating the Ability of Indoor Materials to Support Microbial Growth Using Static Environmental Chambers. Indicate susceptibility of product or material to colonization and amplification of microorganisms. Identify microorganisms and conditions of testing.
 - 1. Normal conditions: Perform testing at 35 degrees Centigrade and 50 percent relative humidity.

- 2. Extreme conditions: Perform worst case scenarios screening tests by providing an atmosphere where environmental conditions may be favorable for microbial growth.
- 3. Perform testing for the following:
 - a. Fireproofing material on appropriate substrate.
 - b. Ceiling tile.
 - c. Wall covering.
 - d. Other appropriate material.

END OF SECTION 01 35 46

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	<u>Indoor Air Quality Plan</u> DATE
Project	
Completed by:	(Nome & Company)
Date:	(Ivame & Company)

This plan describes the measures to be taken to provide good indoor air quality (IAQ) during construction and after construction is complete and the occupants have moved into the building. This plan is based on the SMACNA standard "IAQ Guidelines for Occupied Buildings under Construction" and the requirements of the LEED.

It is not the intent of this document to replace or supersede OSHA regulations as to safe construction workplace practices. It remains the responsibility of the Construction Manager and the individual sub-contractors to maintain safe building and site operations. Addition precautions may be necessary when hazardous materials are present.

The plan will address construction IAQ by recommending procedures in five areas of concern, which in turn will allow the building to achieve two LEED program points:

- HVAC system protection
- Containment source control
- Pathway interruption
- Housekeeping
- Scheduling

The following describes the specific measures to be performed in each area of concern:

1. HVAC Protection

- During construction, provide MERV 13 filters for supply air intake when in use. Provide MERV 8 filters at the return air system openings when in use. Perform frequent maintenance when the HVAC system is being utilized and replace filters as they become loaded, prior to building flushout, and prior to occupancy.
- When performing construction activities that produce dust, such as drywall sanding, concrete cutting, masonry work, wood sawing or adding insulation, seal off the supply diffusers and return air system openings completely for the duration of the task.
- Shut down and seal off the supply diffusers and return air ducts during any demolition operations.
- Whenever the HVAC system is not used during construction, seal off the supply diffusers and return air system openings to prevent the accumulation of dust and debris in the duct system.
- Do not use the mechanical rooms to store construction or waste materials. Keep rooms clean and neat.
- Provide periodic duct inspections during construction; if the ducts become contaminated due to inadequate protection, clean the ducts professionally in accordance with NADCA (National Air Duct Cleaning Association) standards.
- The General Contractor shall take photographs showing measures in place.
- 2. Source Control
 - Use low VOC products as indicated by the specifications to reduce potential problems.

- Restrict traffic volume and prohibit idling of motor vehicles where emissions could be drawn into the building.
- Utilize electric or natural gas alternatives for gasoline and diesel equipment where possible and practical. Use low-sulfur diesel in lieu of regular diesel.
- Cycle equipment off when not being used or needed.
- Exhaust pollution sources to the outside with portable fan systems. Prevent exhaust from recirculating back into the building from construction equipment outside the building.
- Keep containers of wet products closed as much as possible. Cover or seal containers of waste materials that can release odor or dust.
- Protect stored on-site or installed absorptive building materials from weather and moisture; wrap with plastic and seal tight to prevent moisture absorption.
- The General Contractor shall take photographs showing measures in place.
- 3. Pathway Interruption
 - Provide dust curtains or temporary enclosures to prevent dust from migrating to other areas when applicable.
 - Locate pollutant sources as far away as possible from supply ducts and areas occupied by workers when feasible. Supply and exhaust systems may have to be shut down or isolated during such activity.
 - During construction, isolate areas of work to prevent contamination of clean or occupied areas. Pressure differentials may be utilized to prevent contaminated air from entering clean areas.
 - Depending on weather, ventilation using 100% outside air will be used to exhaust contaminated air directly to the outside during installation of VOC emitting materials.

4. Housekeeping

- Provide regular cleaning concentrating on HVAC equipment and building spaces to remove contaminants from the building prior to occupancy.
- All coils, air filters, fans and ductwork shall remain clean during installation and, if required, will be cleaned prior to performing the testing, adjusting and balancing of the systems.
- Suppress and minimize dust with wetting agents or sweeping compounds. Utilize efficient and effective dust collecting methods such as a damp cloth, wet mop, or vacuum with particulate filters, or wet scrubber.
- Remove accumulations of water inside the building. Protect porous materials such as insulation and ceiling tile from exposure to moisture.
- Thoroughly clean all interior surfaces prior to replacing filters and running HVAC system for system balancing, commissioning and building flushout.
- Provide photographs of the above activities during construction to document compliance.
- 5. Scheduling and Construction Activity Sequence
 - Schedule high pollution activities that utilize high VOC level products (including paints, sealers, insulation, adhesives, caulking and cleaners) to take place <u>prior</u> to installing highly absorbent materials (such as ceiling tiles, gypsum wall board, fabric furnishing, carpet and insulation, for example). These materials will act as 'sinks' for VOCs, odors and other contaminants, and release them later after occupancy.

PLANNING AND INSPECTION CHECKLISTS

The planning and inspection checklists included in this document are useful to ensure construction IAQ management is planned and implemented correctly. The planning checklist should be completed by the contractor prior to construction. The inspection checklists should be completed monthly to confirm the IAQ management plan is being followed. At the

time of inspection, photographs should be taken to support the checklist and to provide audit documentation for the USGBC.

University of Colorado Anschutz | Denver IAQ DATE

Planning Checklist (Must be completed weekly)

j	
Completed	by:

(Name & Company)

Date:

Project

1. HVAC Protection

- □ MERV 13 filters at supply air intake
- □ MERV 8 filters at return air openings
- □ Seal supply diffusers and return air during demolition
- □ Seal supply diffusers and return air openings during construction
- □ Mechanical rooms clean and neat
- Periodic duct inspections during construction
- General Contractor to document with photographs

2. Source Control

- □ Low/no VOC products as indicated by specifications
- □ Restrict vehicle traffic volume and prohibit idling
- Utilize electric or natural gas alternatives for gasoline and diesel
- Cycle equipment off when not being used or needed
- □ Exhaust pollution sources to the outside
- □ Keep containers of wet products closed
- Cover or seal containers of waste materials
- □ Protect absorptive building materials from weather and moisture
- Prevent fume migration from construction vehicles and equipment into adjacent buildings
- General Contractor to document with photographs

3. Pathway Interruption

- □ Provide dust curtains or temporary enclosures
- □ Locate pollutant sources as far away as possible from supply dusts and areas occupied by workers
- General Contractor to document with photographs
- □ Isolate areas of work to prevent contamination of clean or occupied areas
- □ When using VOC emitting materials ventilate using 100% outside air

General Contractor to document with photographs

4. Housekeeping

- D Provide regular cleaning, including HVAC equipment
- □ If necessary clean HVAC equipment prior to testing, adjusting and balancing the systems
- Suppress and minimize dust with wetting agents or sweeping compounds
- Remove accumulations of water inside the building
- Protect porous materials
- General Contractor to document with photographs

5. Scheduling and Construction Activity Sequence

- Schedule high pollution activities prior to installing absorbent materials
- General Contractor to document with photographs

I confirm the checked activities to be proceeding according to the Construction Indoor Air Quality Plan. Items that are not checked will be addressed, initialed and dated once corrective actions have been taken. Items that are not applicable are labeled as such.

Signed: _____

Date:

(Contractor)

University of Colorado Denver | Anschutz IAQ DATE

Inspection Checklist (Must be completed weekly)

Project Completed by:

(Name & Company)

Date:

1. HVAC Protection

- □ MERV 13 filters at supply air intake
- □ MERV 8 filters at return air openings
- □ Seal supply diffusers and return air during demolition
- □ Seal supply diffusers and return air openings during construction
- □ Mechanical rooms clean and neat
- Periodic duct inspections during construction
- General Contractor to document with photographs

2. Source Control

- □ Low/no VOC products as indicated by specifications
- □ Restrict vehicle traffic volume and prohibit idling
- Utilize electric or natural gas alternatives for gasoline and diesel
- Cycle equipment off when not being used or needed
- □ Exhaust pollution sources to the outside
- □ Keep containers of wet products closed
- Cover or seal containers of waste materials
- □ Protect absorptive building materials from weather and moisture
- General Contractor to document with photographs

3. Pathway Interruption

- Provide dust curtains or temporary enclosures
- □ Locate pollutant sources as far away as possible from supply dusts and areas occupied by workers
- General Contractor to document with photographs
- □ Isolate areas of work to prevent contamination of clean or occupied areas
- □ When using VOC emitting materials ventilate using 100% outside air
- General Contractor to document with photographs

4. Housekeeping

- Provide regular cleaning, including HVAC equipment
- If necessary clean HVAC equipment prior to testing, adjusting and balancing the systems
- Suppress and minimize dust with wetting agents or sweeping compounds
- Remove accumulations of water inside the building
- Protect porous materials
- General Contractor to document with photographs

5. **Scheduling and Construction Activity Sequence**

- Schedule high pollution activities prior to installing absorbent materials
- General Contractor to document with photographs

I confirm the checked activities to be proceeding according to the Construction Indoor Air Quality Plan. Items that are not checked will be addressed, initialed and dated once corrective actions have been taken. Items that are not applicable are labeled as such.

Signed: _____(Contractor)

Date:

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SECTION 01 35 96

SPECIAL PROCEDURES FOR PROPERTY PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Procedures for establishing existing conditions and monitoring procedures for protection of adjacent or nearby structures and improvements including, but not limited to, sidewalks, landscaping, parking facilities, roadways, or driveways, whether on or off the University's property.

1.2 UNIVERSITY'S SURVEY

A. University has obtained visual inspections of adjacent and nearby buildings together with photographic records showing details and conditions. This survey was made on **<Insert Date>** and the photographs are dated and certified by the photographer as of that date. One set of these data is available for Contractor's use and records.

1.3 SUBMITTALS

A. Submit photographs and survey data from same points as original, certified and dated by photographer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 MONITORING

- A. Establish accurate levels and positions of all elements relative to other fixed points to permit accurate monitoring of potential changes.
- B. At all times during construction activities which are likely to affect adjacent properties, improvements or building, monitor conditions carefully including horizontal or vertical movements, changes in existing cracks, joints or defects or development of new cracks and other evidence of changing conditions. Report immediately to University's Project Manager and Architect/Engineer any changes to existing conditions and stop work where such appear to be significant or potentially dangerous to persons or property.

3.2 REMEDIES

A. Conduct construction operations in a manner that will avoid damage to adjacent buildings, structures, properties or improvements. Promptly remedy any such damage whether to University's or other property and hold the University harmless from such damage.

3.3 POST-CONSTRUCTION SURVEY

A. Within 30 calendar days of completion of those construction activities that would potentially damage adjacent or nearby properties, re-survey all items of University's original survey and Contractor's supplemental information, including monitoring control points. Perform this work using a licensed surveyor and independent photographer. Identify specifically each changed condition, its magnitude and probable cause.

END OF SECTION 01 35 96
SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect/Engineer, University, or authorities having jurisdiction are not limited by provisions of this Section.
 - 4. Specific test and inspection requirements are not specified in this Section.
- C. Related Requirements:
 - 1. Section 01 42 00 "Reference" for list of references, standards and definitions.
 - 2. Section 01 91 13 "General Commissioning" for coordination of testing with commissioning activities.
 - 3. Division 23 for testing, adjusting and balancing of mechanical systems.
 - 4. Division 26 for testing of electrical systems.

1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect/Engineer.

- C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect/Engineer for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect/Engineer for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Shop Drawings: Where integrated exterior mockups are required and indicated on the Drawings, provide plans, sections, and elevations, indicating materials and size of mockup construction.
 - 1. Indicate manufacturer and model number of individual components.
 - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:
 - 1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect/Engineer.
 - 2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect/Engineer.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.
 - 7. Time schedule or time span for tests and inspections.
 - 8. Requirements for obtaining samples.
 - 9. Unique characteristics of each quality-control service.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, and telephone number of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.
 - 9. Test and inspection results and an interpretation of test results.
 - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 - 12. Name and signature of laboratory inspector.
 - 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of technical representative making report.
 - 2. Statement on condition of substrates and their acceptability for installation of product.
 - 3. Statement that products at Project site comply with requirements.

- 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
- 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
- 6. Statement whether conditions, products, and installation will affect warranty.
- 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
 - 1. Name, address, and telephone number of factory-authorized service representative making report.
 - 2. Statement that equipment complies with requirements.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 - 4. Statement whether conditions, products, and installation will affect warranty.
 - 5. Other required items indicated in individual Specification Sections.
- D. Permits, Licenses, and Certificates: For University's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
 - 1. Monitor quality control over products, services, site conditions, and workmanship to produce work of specified quality.
 - 2. Comply fully with manufacturers' instructions, including each step in sequence.
 - 3. If manufacturers' instructions conflict with Contract Document requirements, request clarification from Architect/Engineer before proceeding.
 - 4. Comply with specified standards as a minimum quality for the work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
 - 5. Perform work by persons qualified to produce workmanship of specified quality.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Subcontractor and Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance. In addition comply with the following:
 - 1. For all trades: Proof of applicable licensing.
 - 2. Electrical contractors:

- a. Company: State of Colorado master electrician license.
- b. On-site electricians: State of Colorado journeyman license.
- 3. Plumbing Contractors:
 - a. Company: State of Colorado master plumbers license.
 - b. On-site plumbers: State of Colorado journeyman license.
 - c. Gas piping installations: State of Colorado master plumber with minimum 5 years institutional or heavy commercial gas piping experience. Provide an on-site supervisor with a minimum of 3 years of supervisory experience.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329 or ASTM D 3740 as appropriate; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
 - 3. Independent Agency: Meeting "Recommended Requirements for Independent Laboratory Qualifications" published by American Council for Independent Laboratories.
 - 4. Authorized to operate in the State of Colorado.
 - 5. Calibrate testing equipment at reasonable intervals with devices of accuracy traceable to National Bureau of Standards or of accepted values of natural physical constants.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.

- d. When required, build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
- e. When required, build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
- f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups, as applicable; do not reuse products on Project.
- 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect/Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.9 QUALITY CONTROL

- A. University Responsibilities: Where quality-control services are indicated as University's responsibility, University will engage a qualified testing agency to perform these services.
 - 1. University will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 - 2. Payment for these services will be made by the University.
 - 3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to University are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
 - 1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 - 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
 - a. Contractor shall not employ same entity engaged by University, unless agreed to in writing by University.
 - 3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
 - 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 - 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 - 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Testing Agency Responsibilities: Cooperate with Architect/Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect/Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
 - 6. Do not perform any duties of Contractor.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar qualitycontrol services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples including, but not limited to, safe storage and proper curing of concrete test cylinders at Project site for first 24 hours after casting as required by ASTM C 31.
 - 5. Delivery of samples to testing agencies.
 - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Manufactured Items and Equipment: Where manufactured products or equipment are required to have representative samples tested, do not use such materials or equipment until tests have been made and the materials or equipment found to be acceptable. Do not incorporate in the work any product which becomes unfit for use after acceptance.
- J. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
 - 1. Distribution: Distribute schedule to University, Architect/Engineer, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

1.10 SPECIAL TESTS AND INSPECTIONS

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections including instructions received from University. Include the following:
 - 1. Date test or inspection was conducted.
 - 2. Description of the Work tested or inspected.
 - 3. Date test or inspection results were transmitted to Architect/Engineer.
 - 4. Identification of testing agency or special inspector conducting test or inspection.
 - 5. Disposition: Pass, fail, nature of defects, if any.
 - 6. Date and descriptions of remedial or correction action taken.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect/Engineer's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 - 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."
- B. Protect construction exposed by or for quality-control service activities.

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

3.3 SCHEDULE OF INSPECTIONS AND TESTS BY UNIVERSITY

- A. University will engage testing agency and pay for testing and inspection associated with the following materials and systems, where included in the Project:
 - 1. Compaction density of fill and backfill.
 - 2. Drilled pier end bearing conditions and depths.
 - 3. Cast-in-place concrete.
 - 4. Precast concrete.
 - 5. Post-tensioned concrete tendons.
 - 6. Masonry.
 - 7. Structural steel field welds and bolted connections.
 - 8. Spray-applied fireproofing.
 - 9. Built-up roof cutouts.
 - 10. Asphaltic concrete paving.
 - 11. Foundation drainage systems.
 - 12. Drainage structures and piping.
 - 13. Waterproofing.
 - 14. Air barriers.
 - 15. Fluid applied membranes.
 - 16. Thermal imaging.
 - 17. Curtain wall, window, and door field testing.
 - 18. Ceiling hanger wire pull-out.
 - 19. Electrical resistance of static-control resilient flooring.
 - 20. Field sound testing of operable partitions.
 - 21. Elevator safety.
 - 22. Fan vibration.

END OF SECTION 01 40 00

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SECTION 01 41 00

REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Building Department Authority.
 - 2. Applicable Codes and Standards.

1.3 BUILDING DEPARTMENT AUTHORITY

- A. The University of Colorado Anschutz Medical Campus is charged with the responsibility of ensuring that provision of applicable codes, standards and guidelines are met on its campuses.
- B. The University of Colorado Anschutz Medical Campus has an established Building Authority responsible to review and examine buildings and plan documents, to permit and inspect construction and/or demolition to ensure conformance to codes adopted by the University and issue certificates of temporary occupancy and occupancy if satisfactory conformance is demonstrated.
- C. The authority is executed by the Campus Building Official (CBO) who has the responsibility to perform all the duties set forth in the Current Approved State Buildings Codes and other applicable codes and standards indicated in the "Applicable Codes and Standards" Article of this Section.
- D. Permits: Obtain a separate permit for each Project from the Office of the CBO prior to erecting, constructing, enlarging, repairing, moving, removing, converting or demolishing any building or portion thereof. Coordinate and obtain all permits through the University Project Manager. The Contractor is not responsible for costs associated with construction permits.
 - 1. Exempt work: A building permit is not required for the following:
 - a. Fences less than or equal to 6 feet tall.
 - b. Movable casework, counters and partitions not over 5 feet 9 inches tall with no electrical or plumbing.
 - c. Platforms, walks, and driveways not more than 30 inches above grade and not over any basement or story below.
 - d. Painting, papering and similar finish work.
 - e. Other work of limited scope at the discretion of the CBO.
- E. Permit Issuance: The CBO, or at the discretion of the CBO a third party code consultant, will review application, Drawings, Specifications, computations and other data filed for permit. Complete the permit

application with the University Project Manager. Permits require submittal of two (2) stamped, signed sets of Construction Documents, including Drawings, Specifications and all Addenda, and one (1) set of each engineering discipline's calculations, where such calculations are required. If CBO determines that submittal conforms to the requirements of the Building Code and other applicable codes, standards, laws, regulations and ordinances, an inspection record card will be issued with the building permit. Keep one stamped set of documents on site. The University will keep one stamped set in the Campus Support plan room.

- F. Suspension or Revocation of Permit: CBO may, in writing, suspend or revoke a permit issued in error or on the basis of submitted information that is incorrect or that is in violation of the Building Code and other applicable codes and standards.
- G. Posting of Permit: Post the Permit in a visible and protected location near the access to the project.
- H. Inspection Record Card: Post the Inspection Record Card next to the permit in a visible and protected location near the access to the project. CBO will make required entries based on inspection of the work.
- I. Inspection Requests:
 - 1. Notify CBO that work is ready for inspection two business days before such inspection is desired by telephoning the number posted on the permit. The CBO retains the right to require requests in writing.
 - 2. A re-inspection fee may be charged for prior rejected items.
- J. Construction Inspections:
 - 1. Contractor is not responsible for costs associated with construction inspections, except reinspections. The CBO or his/her designee will perform all general building, electrical and plumbing inspections. All construction or work for which a permit is required must remain accessible and exposed for inspection purposes. Provide access to and means for inspection of work.
 - 2. Site Utilities: Contact and comply with all requirements of City of Aurora.
 - 3. Plumbing and Electrical Inspections: For new buildings and major additions, contact and comply with all requirements of State of Colorado Plumbing and Electrical Boards.
 - 4. Provisions for structural and other special inspections required by Contract Documents, current approved State Building Codes and University Codes will be provided by the University.
- K. Certification of Occupancy:
 - 1. When CBO inspects the project and finds no violations of any provision of the Building Code, other applicable codes, standards, laws, regulations and ordinances, CBO will issue a Certification of Occupancy (CO) which will contain the following:
 - a. Building permit number.
 - b. Address of building.
 - c. Name and address of Owner.
 - d. Description of building or portion thereof for which certification is issued.
 - e. Statement that described building or portion thereof has been inspected for compliance with the requirements of the Building Code, other applicable codes, standards, laws, regulations and ordinances, as relates to type of occupancy and use for which the building is intended.

- 2. Temporary Certificate of Occupancy (TCO): If CBO finds no substantial hazard will result from occupancy of any building or portion thereof before the same is completed, CBO may issue a TCO for the use of a portion or portions of a building or structure prior to the completion of the entire building or structure.
- 3. Posting of CO: Provide a copy to the University Project Manager and post in a conspicuous location on the premises. CO may not be removed except by CBO upon initial occupancy.
- 4. Revocation of CO:

1.4 APPLICABLE CODES AND STANDARDS

- A. The following approved building codes and standards have been adopted by State Buildings Programs (SBP) as the minimum requirements to be applied to all state-owned buildings and physical facilities including capital construction and controlled maintenance construction projects. Current applicable codes can be obtained from The Office of the State Architect's website.
- B. University of Colorado Denver Codes and Standards: The following codes and standards supplement those indicated on the Office of the State Architect website.
 - 1. The Manual of Guidelines and Standards for Construction Projects
 - a. <u>http://ucdenver.edu/about/departments/FacilitiesManagement/FacilitiesProjects/Pages/Guid</u> elinesStandards.aspx
 - 2. Colorado Rules and Regulations pertaining to Radiation Control, 6 CCR 1007 Part 1-20.
 - 3. Colorado Rules and Regulations pertaining Air Quality Control Commission Regulations, 5 CCR 1001-10, Part B "Asbestos Control."
 - 4. Colorado Rules and Regulations pertaining to Solid Waste, 6 CCR 1007-2.
 - 5. Colorado Rules and Regulations pertaining to Hazardous Waste, 6 CCR 1007-3.
 - 6. Federal Hazardous Waste Regulations, 40 CFR, Parts 260 through 264.
 - 7. Federal Clean Water Act (CWA) is 33 U.S.C § 1251 et seq. (1972).
 - 8. University of Colorado Denver | Anschutz Medical Campus, Asbestos Contaminated Soil Management, Standard Operating Procedure (SOP) Document.
 - 9. NFPA 30: Flammable and Combustible Liquids Code.
 - 10. NFPA 45: Standard on Fire Protection for Laboratories Using Chemicals.
 - 11. NFPA 72: National Fire Alarm and Signaling Code.
 - 12. Life Safety Code (NFPA 101) latest edition.
 - a. Use the most restrictive interpretation where NFPA 101 conflicts with the IBC requirements.
 - 13. ANSI/AIHA Z9.5 Laboratory Ventilation latest edition.
 - a. http://www.aiha.org/insideaiha/standards/Pages/ANSIZ9.aspx
 - 14. ANSI/AIHA Z9.6 Exhaust Systems for Grinding, Buffing and Polishing latest edition.
 - a. <u>http://www.aiha.org/insideaiha/standards/Pages/ANSIZ9.aspx</u>
 - 15. ANSI/AIHA Z9.10 Fundamentals Governing the Design and Operation of Dilution Ventilation Systems in Industrial Occupancies latest edition.

a. <u>http://www.aiha.org/insideaiha/standards/Pages/ANSIZ9.aspx</u>

- 16. ANSI/ASHRAE/ASHE Standard 170 Ventilation of Healthcare Facilities latest edition.
- 17. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality.
- 18. OSHA "Safety and Health Regulation for Construction" (29 CFR 1926).
- 19. OSHA "Occupational Safety and Health Standards" (29 CRF 1910).
- 20. American Institute of Architects, Academy of Architecture for Health (AIA AAHA) and Facility Guidelines Institute (FGI), Guidelines for Design and Construction of Hospital and Healthcare Facilities latest edition (FOR PATIENT CARE AREAS ONLY).
- 21. CDC-NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL); latest edition.
- 22. NIH Design Requirements Manual (DRM) latest edition.
 - a. <u>http://orf.nih.gov/PoliciesAndGuidelines/BiomedicalandAnimalResearchFacilitiesDesignPoliciesandGuidelines/DesignRequirementsManualPDF.htm</u>
- 23. NIH Guidelines for Research Involving Recombinant DNA Molecules latest edition.
- 24. ILAR Guide for Care and Use of Laboratory Animals latest edition.
- 25. National Research Council of the National Academies, Institute for Laboratory Animal Research, Division on Earth and Life Studies: Guide for the Care and Use of Laboratory Animals latest edition.
- 26. Uniform Federal Accessibility Standards (UFAS) latest edition.
- 27. Metro Wastewater District's Rules and Regulations, (Sections 6.17 [6.13, 6.14] and 6.18).
- 28. City of Aurora Asphalt and Paving Standards latest edition.
- C. Other Standards: As indicated in individual Specification Sections.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 41 00

SECTION 01 42 00

REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Definitions.
 - 2. Industry Standards.
 - 3. Abbreviations and Acronyms.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for an explanation of specification and drawing conventions.
 - 2. Section 01 41 00 "Regulatory Requirements" for a list of applicable codes.

1.3 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
 - 1. Definitions in this Section are not intended to be complete, exhaustive or exclusive. They are general and apply to the Work to the extent that such definitions are not stated more explicitly in other provisions of the Contract Documents.
- B. "Approved": When used to convey Architect/Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect/Engineer's duties and responsibilities as stated in the Conditions of the Contract. Except where expressly indicated, such approval does not release the Contractor from responsibility to fulfill requirements of the Contract Documents.
- C. "Backup": N+1 system.
- D. "Directed": A command or instruction by Architect/Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- E. "EHS": Environmental Health and Safety.
- F. "Engineer": Architect/Engineer. Other terms including "Mechanical Engineer", "Electrical Engineer", or "Structural Engineer" have the same meaning as "Engineer."

- G. "General Conditions": Contract terms contained in [Contractor's Agreement Design/Bid/Build, State Form SC-6.21 and The General Conditions of the Construction Contract Design/Bid/Build, State Form SC-6.23] [Construction Manager/General Contractor Agreement CMGC, State Form SC-6.4] [Design/Build Agreement, State Form SC-8.0 and The General Conditions of the Design/Build Agreement, State Form SC-8.1]
- H. "General Requirements": Provisions and requirements of all Division 01 Sections as they apply to all aspects of the Work.
- I. "Guarantee": The narrow definition of the term "warranty" applying to both "warranty" and "guarantee" which terms are used interchangeably.
- J. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- K. "Redundant": 2N system. The level of redundancy is determined by design.
- L. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work, whether lawfully imposed by authorities having jurisdiction or not.
- M. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- N. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- O. "Owner": Principal Representative and/or University.
- P. "Provide": Furnish and install, complete and ready for the intended use.
- Q. "Project Manual": Bound, printed volume or volumes including Conditions of the Contract and Specifications, which may also include bidding requirements, contract forms, details, schedules, surveys, reports or other relevant items that may or may not be Contract Documents.
- R. "Project Site": Space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.
- S. "Supplementary Conditions": University Special Supplementary General Conditions. Other terms including "Supplementary General Conditions" shall have the same meaning.

1.4 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
 - 1. Referenced standards take precedence over standards that are not referenced but generally recognized in the construction industry as applicable.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents.
 - 1. Updated Codes and Standards: Where an applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected, submit Contractor-Initiated Change Order Bulletin and Change Order Proposal in accordance with Section 01 26 00 "Contract Modification Procedures" for consideration to modify contract requirements to comply with revised code or standard.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
 - 2. Where required by individual Specification Sections provide and maintain copies of referenced codes and standards at Project Site.
 - 3. Although copies of standards needed for enforcement of requirements may be part of required submittals, the Architect/Engineer reserves the right to require the Contractor to submit additional copies as necessary for enforcement of requirements.
- D. Unreferenced Standards: Unreferenced standards are not directly applicable to the Work, except as a general requirement of whether the Work complies with recognized construction industry standards.
- E. Conflicting Requirements: Where compliance with two or more standards is specified, and they establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the Contract Documents indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect/Engineer for a decision before proceeding.

1.5 ABBREVIATIONS AND ACRONYMS

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

AABC	Associated Air Balance Council www.aabc.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABMA	American Bearing Manufacturers Association www.americanbearings.org	(202) 367-1155
ACI	American Concrete Institute (Formerly: ACI International)	(248) 848-3700

	www.concrete.org	
АСРА	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, and Refrigeration Institute (The) www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(607) 256-3313
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute (See AHRI)	

ARI	American Refrigeration Institute (See AHRI)	
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	(800) 527-4723
	www.asnrae.org	(404) 030-8400
ASME	ASME International (American Society of Mechanical Engineers) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Safety Engineers (The) www.asse.org	(847) 699-2929
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWEA	American Wind Energy Association www.awea.org	(202) 383-2500
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWMAC	Architectural Woodwork Manufacturers Association of Canada www.awmac.com	(403) 453-7387
AWPA	American Wood Protection Association (Formerly: American Wood-Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association	(212) 297-2122

	www.buildershardware.com	
BIA	Brick Industry Association (The) www.gobrick.com	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
BOCA	BOCA (Building Officials and Code Administrators International Inc.) (See ICC)	
BWF	Badminton World Federation (Formerly: International Badminton Federation) www.bwfbadminton.org	60 3 9283 7155
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.electricity.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CFSEI	Cold-Formed Steel Engineers Institute www.cfsei.org	(866) 465-4732 (202) 263-4488
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(404) 622-0073
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
СРА	Composite Panel Association www.pbmdf.com	(703) 724-1128

CRI	Carpet and Rug Institute (The) www.carpet-rug.org	(706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(800) 328-6306 (847) 517-1200
CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
CWC	Composite Wood Council (See CPA)	
DASMA	Door and Access Systems Manufacturers Association www.dasma.com	(216) 241-7333
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electronic Components Association www.ec-central.org	(703) 907-8024
ECAMA	Electronic Components Assemblies & Materials Association (See ECA)	
EIA	Electronic Industries Alliance (See TIA)	
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (703) 538-1616
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937

ESTA	Entertainment Services and Technology Association (See PLASA)	
EVO	Efficiency Valuation Organization www.evo-world.org	(415) 367-3643 44 20 88 167 857
FIBA	Fédération Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Fédération Internationale de Volleyball (The International Volleyball Federation) www.fivb.org	41 21 345 35 45
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council U.S. www.fscus.org	(612) 353-4511
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GS	Green Seal www.greenseal.org	(202) 872-6400
HI	Hydraulic Institute www.pumps.org	(973) 267-9700
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association (See AHRI)	
HMMA	Hollow Metal Manufacturers Association (See NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550

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IAPSC	International Association of Professional Security Consultants www.iapsc.org	(415) 536-0288
IAS	International Approval Services (See CSA)	
ICBO	International Conference of Building Officials (See ICC)	
ICC	International Code Council www.iccsafe.org	(888) 422-7233 (202) 370-1800
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICPA	International Cast Polymer Alliance www.icpa-hq.org	(703) 525-0511
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society (Formerly: Illuminating Engineering Society of North America) www.ies.org	(212) 248-5000
IESNA	Illuminating Engineering Society of North America (See IES)	
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 981-0100
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
IGSHPA	International Ground Source Heat Pump Association www.igshpa.okstate.edu	(405) 744-5175
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
Intertek	Intertek Group (Formerly: ETL SEMCO; Intertek Testing Service NA) www.intertek.com	(800) 967-5352
ISA	International Society of Automation (The) (Formerly: Instrumentation, Systems, and Automation Society) www.isa.org	(919) 549-8411
ISAS	Instrumentation, Systems, and Automation Society (The)	

	(See ISA)	
ISFA	International Surface Fabricators Association (Formerly: International Solid Surface Fabricators Association) www.isfanow.org	(877) 464-7732 (801) 341-7360
ISO	International Organization for Standardization www.iso.org	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association (See ISFA)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
КСМА	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LMA	Laminating Materials Association (See CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MMPA	Moulding & Millwork Producers Association (Formerly: Wood Moulding & Millwork Producers Association) www.wmmpa.com	(800) 550-7889 (530) 661-9591
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.org	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591

NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFPA	NFPA International (See NFPA)	
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NHLA	National Hardwood Lumber Association www.nhla.com	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	National Oak Flooring Manufacturers Association	

	(See NWFA)	
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSPE	National Society of Professional Engineers www.nspe.org	(703) 684-2800
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PLASA	PLASA (Formerly: ESTA - Entertainment Services and Technology Association) www.plasa.org	(212) 244-1505
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	(925) 935-1499
SAE	SAE International (Society of Automotive Engineers) www.sae.org	(877) 606-7323 (724) 776-4841
SBCCI	Southern Building Code Congress International, Inc. (See ICC)	
SCTE	Society of Cable Telecommunications Engineers	(800) 542-5040

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	www.scte.org	(610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 293-1995
SMA	Screen Manufacturers Association www.smainfo.org	(773) 636-0672
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SRCC	Solar Rating and Certification Corporation www.solar-rating.org	(321) 638-1537
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association	(847) 681-1868

	www.swpa.org	
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911
TCNA	Tile Council of North America, Inc. (Formerly: Tile Council of America) www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association, Inc. www.tema.org	(914) 332-0040
TIA	Telecommunications Industry Association (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance) www.tiaonline.org	(703) 907-7700
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance (See TIA)	
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UBC	Uniform Building Code (See ICC)	
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau	(800) 283-1486

	www.wclib.org	(503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WDMA	Window & Door Manufacturers Association www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association (See MMPA)	
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 938-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

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

DIN	Deutsches Institut für Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, LLC www.icc-es.org	(800) 423-6587 (562) 699-0543

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

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce National Institute of Standards and Technology www.nist.gov	(301) 975-4040
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-2664

DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FG	Federal Government Publications www.gpo.gov	(202) 512-1800
GSA	General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory Environmental Energy Technologies Division http://eetd.lbl.gov	(510) 486-4000
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742
SD	Department of State www.state.gov	(202) 647-4000
TRB	Transportation Research Board National Cooperative Highway Research Progran www.trb.org	(202) 334-2934
USDA	Department of Agriculture Agriculture Research Service U.S. Salinity Laboratory www.ars.usda.gov	(202) 720-3656
USDA	Department of Agriculture Rural Utilities Service www.usda.gov	(202) 720-2791
USDJ	Department of Justice Office of Justice Programs National Institute of Justice www.ojp.usdoj.gov	(202) 307-0703
USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772 (301) 881-0666
USPS	United States Postal Service www.usps.com	(202) 268-2000

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the

following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CFR	Code of Federal Regulations Available from Government Printing Office www.gpo.gov/fdsys	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration www.gsa.gov	(800) 488-3111 (202) 619-8925
	Available from National Institute of Building Sciences/Whole Building Design Guide www.wbdg.org/ccb	(202) 289-7800
MILSPEC	Military Specification and Standards (See DOD)	
USAB	United States Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
USATBCB	U.S. Architectural & Transportation Barriers Compliance Board (See USAB)	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
 - 1. Nothing in this Section is intended to limit types and amounts of temporary work required, and no omission from this Section will be recognized as an indication by Architect/Engineer that such temporary activity is not required for successful completion of the Work. The use of alternative facilities equivalent to those specified is the Contractor's option, subject to Architect/Engineer's and University acceptance.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.
 - 2. Section 01 35 46 "Indoor Air Quality" for temporary facility work including HVAC, air filtration, moisture management, air filtration and dust control partitions required to comply with indoor air quality requirements during construction.

1.3 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, University's construction forces, Architect/Engineer, testing agencies, and authorities having jurisdiction.
- B. Use Charges: As follows:
 - 1. For new construction: Arrange for and pay for water, sewer, electric power, steam and chilled water use charges for utility usage by all entities for construction operations.
 - 2. For renovations of existing facilities: Arrange for and University will pay for all use charges.
- C. Temporary Metering: For all utility connection; sub-meter at point of connection to existing systems.
 - 1. Temporary utility meter must be approved by University Campus Energy Engineer.
 - 2. Meters shall be operational prior to any use of utility for temporary heating.

1.4 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.
- D. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
 - 1. Locations of dust-control partitions at each phase of work.
 - 2. HVAC system isolation schematic drawing.
 - 3. Location of proposed air-filtration system discharge.
 - 4. Waste handling procedures.
 - 5. Other dust-control measures.

1.5 QUALITY ASSURANCE

- A. General: Comply with governing regulations and utility company regulations and recommendations for the construction of temporary facilities including, but not necessarily limited to, code compliances, permits, inspections, testing, health, safety, pollution and environmental compliances.
- B. Fire-safety: Comply with NFPA 421 "Standard for Safeguarding Construction, Alteration, and Demolition Operations."
- C. Safety: Comply with ANSI/ASSE A10 "Construction Package" series of safety construction standards.
- D. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- E. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- F. Accessible Temporary Egress: Where temporary accessible egress from existing buildings or portions thereof is provided, comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before University's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, or permit them

to interfere with progress. Do not allow hazardous, dangerous or unsanitary conditions, or public nuisances to develop or persist on the site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide both new or used materials and equipment for temporary facilities, which are in substantially undamaged and serviceable condition. Provide types and qualities which are recognized in the construction industry as suitable for the intended use in each application. Comply with Utility Company requirements as applicable.

2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Insulated, weather-tight, of sufficient size to accommodate needs of University, Architect/Engineer, and construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.
 - 1. At a minimum, furnish and equip offices as follows:
 - a. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
 - b. Conference room of sufficient size to accommodate meetings of [10] <Insert number> individuals. Provide electrical power service and 120-V ac duplex receptacles, with no fewer than one receptacle on each wall. Furnish room with conference table, chairs, and 4-foot-square tack and marker boards.
 - c. Drinking water and private toilet.
 - d. Coffee machine and supplies.
 - e. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.
 - f. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.
 - 2. Comply with Section 01 10 00 "Summary" for use of site for staging areas.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Digital Camera: Minimum 12 megapixel; available in field office for use.
- C. Thermometer: Outdoor, re-settable type indicating daily maximum and minimum temperatures.

- 1. Locate in a shaded-from-the-sun, conveniently readable location that will give reasonably accurate readings of the actual air temperature and be reached easily for resetting.
- 2. Maintain daily log of reading.
- D. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate, expand and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Use qualified workers for the installation of temporary facilities.

3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, University, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services. Comply with requirements in Section 01 10 00 "Summary" for existing utility disruption procedures.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
 - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction. Where available, connect to University's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to University. At Substantial Completion, restore these facilities to condition existing before initial use.
 - 1. Obtain and pay for all required water taps.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Toilets: Use of University's existing toilet facilities is not permitted.
 - 2. Provide temporary toilets within available site area in location approved by University which will best serve the needs of construction personnel.
 - 3. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each sanitary facility, and provide appropriate waste paper containers for used materials.
 - 4. At Contractor's option, provide drinking water for construction personnel by either water-system-connected drinking fountains or by containerized tap dispensers with paper cups (or both).
- E. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
 - 1. HVAC Equipment: Unless University authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - a. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - b. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
 - c. Permanent HVAC System: If University authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air and exhaust grille in system and remove at end of construction. Clean and adjust HVAC system and put in new condition before Completion as required in Section 01 77 00 "Closeout Procedures".
- F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
 - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust-containment devices.
 - 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
 - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service: Provide weatherproof, grounded, electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Include, as required, transformers, overload protected disconnects, automatic ground fault interrupters and main distribution switchgear. Maintain equipment in a condition acceptable to University.
 - 1. Install electric power service overhead unless otherwise indicated.
 - 2. Where available capacity exists in existing system, connect temporary service to University's existing power source, as directed by University.
 - 3. Provide separate connection for power and for lighting.

- 4. Provide sufficient 220v outlets for special tools, welding equipment and similar devices requiring such service at locations where required.
- 5. Provide sufficient circuits and duplex 120v single phase outlets so located that any part of the work can be reached with a 75 foot extension cord to accommodate normal power tools and supplemental lighting.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 - 1. Provide temporary light to levels and as required by governing regulations but not less than minimum 5 foot-candle illumination in all areas accessible to workers during hours they are at the job; minimum 10 foot-candles for shop areas; 20 foot-candles or more where detailed or finishing work is being done, supplemented as may be required.
 - 2. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 3. Install lighting for Project identification sign.
 - 4. Where permanent light fixtures have been used for temporary lighting, supply temporary lamps and replace with new lamps at time of Completion.
 - 5. Provide lighting in stairways and exits at all times.
- J. Telephone Service: Provide temporary telephone service in Contractor's field office and distribute to each work station.
 - 1. Pay for line installation, monthly charges, and expenses necessary to extend service from minimum point of presence (MPOP) as determined by University I/S.
 - 2. Provide temporary telephone service in common-use facilities for use by all construction personnel.
 - 3. Provide answering machine and a dedicated telephone line for a facsimile machine.
 - 4. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
 - 2. Maintain support facilities until Architect/Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to University.
- B. Parking: Comply with requirements in Section 01 10 00 "Summary."
- C. Project Signs: Provide Project signs at locations indicated or directed. Unauthorized signs are not permitted.
- D. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
 - a. Provide temporary, directional signs for construction personnel and visitors.

- 2. Engage an experience sign painter to apply required colors and graphics in a neat and professional manner.
- 3. Maintain and touchup signs so they are legible at all times.
- E. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."
 - 1. Coordinate with University Project Manager to obtain approval from University Environmental Services Manager.
 - 2. Provide waste chutes as required in accordance with applicable laws and regulations.
- F. Temporary Elevator Use: Use of elevators is not permitted without prior written approval of the Architect/Engineer and University Project Manager.
 - 1. If so approved, only one designated elevator may be used subject to the requirements of "Existing Elevator Use" paragraph below.
- G. Existing Elevator Use: When approved by University, one designated existing elevator may be used at no charge to Contractor or other subcontractors for transporting personnel, small tools, materials, and equipment. Comply with requirements of Section 01 10 00 "Summary" and the following:
 - 1. Contractor will not be granted exclusive use of the designated elevator. University personnel and staff will be permitted to use this elevator as their work duties require.
 - 2. Entire car is lined (floor, walls, ceiling) with 3/4 inch Fir plywood or equivalent.
 - 3. Total load carried does not exceed rated capacity of elevator.
 - 4. No materials, equipment, trash, tools or other items too large to be readily moved into and out of the car may be carried in the elevator.
 - 5. Before acceptance of the building, linings are removed; all exposed surfaces are in new condition; all controls, relays, other parts showing any wear have been replaced.
 - 6. Entire elevator, including machinery, electrical components, doors, operators and controls shall be tested, adjusted, and put in new condition with specified warranties and maintenance to take effect at date of Completion Certificate.
 - 7. Written clearance has been obtained from the Elevator Service Company stating that the installation is safe and complete for this use prior to using it.
 - 8. The Contractor signs the Elevator Service Company's standard agreement and release forms for this usage and pays charges for maintenance, service, repairs, and reconditioning.
- H. Existing Stair Usage: Use of University's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to University. 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.
- I. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Protection of Work: Protect in-progress and completed work from damage or deterioration, other than normal weathering of exposed materials, through construction duration until completion, as appropriate and as recommended by manufacturer and Installer.
 - 1. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects, and storage.
 - 2. Prohibit traffic and storage on waterproofed and roofed surfaces, on lawn and landscaped areas.
 - 3. Always protect excavation, trenches, and building, from damage from rain water, spring water, ground water, backing up of drains or sewers. Provide pumps, equipment, enclosures, to provide this protection.
 - 4. Remove protective coverings and materials at the appropriate time but no later than final cleaning operations.
- C. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
 - 1. Comply with work restrictions specified in Section 01 10 00 "Summary."
- D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
 - 1. Comply with Section 01 41 00 "Regulatory Requirements" Article "MS4 Storm Water and Water Quality Permits."
 - 2. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 - 3. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 - 4. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 - 5. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- E. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- F. Security: Provide security program and facilities to protect the Work, existing facilities, and University operations and to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
 - 1. Coordinate with University Police.
 - 2. Provide lockable entrances and lock entrances at end of each work day.
 - 3. After review and approval by University, install temporary enclosure around partially completed areas of construction.

- 4. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.
- G. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting wherever required to prevent accidents and losses.
- H. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- I. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
 - 1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.
 - 2. Coordinate temporary enclosures with ventilating and drying-of-the-work requirements, so as to avoid dangerous conditions and deleterious effects.
 - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.
- J. Temporary Partitions: Provide floor-to-floor or floor-to-ceiling dustproof partitions terminating in dustproof floor or ceiling above to limit dust and dirt migration and to separate existing active elevator hoistways and other areas occupied by University from dust, fumes and noise in compliance with Section 01 35 46 "Indoor Air Quality" and the following:
 - 1. Construct dustproof partitions with 5/8 inch gypsum wallboard with joints taped on occupied side, and 1/2 inch fire-retardant-treated plywood on construction operations side.
 - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
 - 3. Insulate partitions to control noise transmission to occupied areas.
 - 4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
 - 5. Protect air-handling equipment.
 - 6. Provide walk-off mats at each entrance through temporary partition.
 - 7. At elevator hoistway entrances not used during construction, seal openings with plastic sheet and duct tape.
- K. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
 - 1. Fire Extinguishers: Minimum one per floor at or near useable exit.
 - a. Provide additional extinguishers where convenient and effective for intended purpose.
 - b. Comply with NFPA 10 to the extent applicable.
 - 2. Strictly enforce site prohibition against smoking.
 - 3. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 4. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Coordinate with University Project Manager to review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

- 5. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
- 6. Maintain unobstructed access to fire extinguishers, temporary fire protection facilities, stairways and other access routes for fighting fires.
- 7. Store combustible materials in containers in fire-safe locations.
- 8. Permanent Fire Protection System: Complete and make operational at earliest possible date. Instruct site personnel on use of permanent system.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Comply with requirements in Section 01 35 46 "Indoor Air Quality Procedures."

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
 - 1. Do not permit temporary offices and similar temporary or permanent spaces to be used as living quarters or for other unintended occupancies or uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Janitorial Services: Provide daily janitorial services for temporary offices, toilets, and similar areas at the project site. Require users of other temporary facilities to maintain clean and orderly premises.
- D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion, unless Architect/Engineer requests that it be retained for a longer period of time. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor. University reserves right to take possession of Project identification signs.
 - 2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 21 00 "Allowances" for products selected under an allowance, if applicable.
 - 2. Section 01 23 00 "Alternates" for products selected under an alternate, if applicable.
 - 3. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
 - 4. Section 01 42 00 "References" for applicable industry standards for products specified.
 - 5. Section 01 77 00 "Closeout Procedures" for submittal of project warranties.

1.3 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Requests for consideration of comparable products will only be entertained during bidding.
 - 2. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 3. Architect/Engineer's Action: If necessary, Architect/Engineer will request additional information or documentation for evaluation of a comparable product request. Architect/Engineer will notify Contractor of approval or rejection of proposed comparable product.
 - a. Form of Approval: Written Addendum.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.
- B. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
- D. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
- E. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or poweroperated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.
 - 1. Name of product and manufacturer.
 - 2. Model and serial number.
 - 3. Capacity.
 - 4. Speed.
 - 5. Ratings.
 - 6. Power characteristics (if applicable).
 - 7. UL label or compliance (if applicable).

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 6. Protect stored products from damage and liquids from freezing.

1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents. Such disclaimers and limitations do not relieve warranty requirements on Work that incorporates product nor do they relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.
 - 1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to University.
 - 2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for University.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
 - 1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 - 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
 - 3. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time and Form: Comply with requirements in Section 01 77 00 "Closeout Procedures."
- D. Warranty Requirements:

- 1. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- 2. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- 3. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the University has benefited from use of the Work through a portion of its anticipated useful service life.
- 4. University's Recourse:
 - a. Written warranties made to the University are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the University can enforce such other duties, obligations, rights, or remedies.
 - b. Rejection of Warranties: The University reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
 - c. The University reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged, are asbestos free, and, unless otherwise indicated, are new at time of installation.
 - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 - 3. University reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 - 4. Where products are accompanied by the term "as selected," Architect/Engineer will make selection.
 - 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 - 6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product and provide only products previously approved during bid phase by written Addendum. The determination of equivalence is at the sole discretion of the Architect/Engineer who has no obligation to prove non-equivalence.
 - 7. Mechanical and electrical equipment design and their space requirements are based on the first named item of the Section in which specified or that scheduled on the Drawings. If other than the first named or scheduled item listed for use is selected, modification to other elements of Work may be required. Show all such modification on shop drawings and submittals as appropriate. The cost of such modifications is solely the responsibility of the Contractor.

- 8. Where manufacturers are listed as acceptable for specific proprietary products but precise identification by model, series, or trade name is not specified, submit detailed product information for such products for Architect/Engineer's acceptance prior to ordering. Include specific requirements for modifications to other construction, including but not limited to, power and utility requirements, characteristics, capacities, size and locations. The cost of such modifications is solely the responsibility of the Contractor.
- B. Product Selection Procedures:
 - 1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 3. Products:
 - a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 4. Manufacturers:
 - a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 - 5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. If proposing a comparable product by another manufacturer, whether named or not, provide a custom product if manufacturer's standard product does not include salient features of the Basis-of-Design product indicated. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.
 - 6. Contractor's Option: Where materials, products, systems or methods are specified to be selected from a list of options, subject to compliance with requirements, the choice of which material, method, product or system will be solely at the Contractor's discretions. There will be no change in Contract Sum or Time because of such choice.
- C. Visual Matching Specification: Where Specifications require "match Architect/Engineer's sample", provide a product that complies with requirements and matches Architect/Engineer's sample. Architect/Engineer's decision will be final on whether a proposed product matches.
 - 1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect/Engineer from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect/Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Prior to bid, Architect/Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect/Engineer will reject request:
 - 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - 3. Evidence that proposed product provides specified warranty.
 - 4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
 - 5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00

EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
 - 1. Construction layout.
 - 2. Field engineering and surveying.
 - 3. Installation of the Work.
 - 4. Cutting and patching.
 - 5. Coordination of University-installed products.
 - 6. Progress cleaning.
 - 7. Starting and adjusting.
 - 8. Protection of installed construction.
 - 9. Correction of the Work.
- B. Related Requirements:
 - 1. Section 01 10 00 "Summary" for limits on use of Project site and procedures related to utility interruptions.

1.3 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.
- B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For land surveyor or professional engineer.
- B. Certificates: Submit certificate signed by land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.
- C. Cutting and Patching Plan and Request: Submit plan and request describing procedures at least 21 calendar days prior to the time cutting and patching will be performed.

- 1. Submit request whenever cutting and patching operation affect:
 - a. Work of the University or any separate contractor.
 - b. Structural value or integrity of any element of the Project.
 - c. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 - d. Efficiency, operational life, maintenance or safety of operational elements.
 - e. Visual qualities of sight-exposed elements.
 - f. Cutting new openings in existing structural concrete walls, floors and suspended slabs.
 - g. Cutting new openings in existing roofs and roofing materials.
 - h. Cutting exterior walls.
 - i. Cutting into shafts.
- 2. Include the following information:
 - a. Extent: Describe reason for and extent of each occurrence of cutting and patching, including explanation of why cutting and patching operation cannot be reasonable avoided.
 - b. Changes to In-Place Construction: Describe cutting and patching methods and anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
 - c. Products: List products to be used for patching and firms or entities that will perform patching work.
 - d. Trades: Indicate trades and subcontractors who will perform the work.
 - e. Dates: Indicate when cutting and patching will be performed.
 - f. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.
 - 1) Include description of provisions for temporary services and systems during interruption of permanent services and systems.
 - 2) Comply with requirements of Section 01 10 00 "Summary" related to existing utility and system interruptions.
 - g. Structural Elements: Where cutting and patching structural elements requires the addition of reinforcement, submit details and calculations signed and sealed by an Engineer registered in the State of Colorado. Indicate how new reinforcing will be integrated with original structure.
- 3. Limitations: Approval of cutting and patching request does not waive right of Architect/Engineer or University to later require complete removal and replacement of work found to be unsatisfactorily cut and patched.
- D. Final Property Survey: Submit one electronic and two paper copies showing the Work performed and record survey data.
 - 1. Include certified statement that lines and levels of the work comply with the requirements of the Contract Documents and listing authorized or accepted deviations, cross-referenced to Change Order number, where applicable.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

- 1. Structural Elements: When cutting and patching structural elements, notify Architect/Engineer of locations and details of cutting and await directions from Architect/Engineer before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
- 2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include 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. Communication systems.
 - h. Fire-detection and -alarm systems.
 - i. Conveying systems.
 - j. Electrical wiring systems.
 - k. Operating systems of special construction.
- 3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:
 - a. Water, moisture, or vapor barriers.
 - b. Membranes and flashings.
 - c. Exterior curtain-wall construction.
 - d. Sprayed fire-resistive material.
 - e. Equipment supports.
 - f. Piping, ductwork, vessels, and equipment.
 - g. Noise- and vibration-control elements and systems.
- 4. Visual Elements: Do not cut and patch construction exposed to the exterior or exposed in occupied spaces in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect/Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- 5. Hazardous Materials: Do not proceed with cutting and patching operations until University has examined existing construction for the presence of asbestos and/or lead-based coatings. Comply with requirements in Section 01 35 00 "Special Procedures."
- B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
 - 1. For projects requiring compliance with sustainable design and construction practices and procedures, use products for patching that comply with requirements in Division 01 Section "Sustainable Design Requirements."
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
 - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect/Engineer for the visual and functional performance of inplace materials.
- C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work. Notify University Project Manager and Architect/Engineer and obtain approval prior to disturbing, moving or penetrating soil.
 - 1. Arrange for locating buried utilities including water and sewer lines within construction limits. Obtain location information and stake all known utilities prior to commencing construction activities.
 - a. Contact Utility Notification Center of Colorado (UNCC), 1-800-922-1987, and comply with UNCC guidelines.
 - 2. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
 - 3. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present, for compliance with requirements for installation tolerances and other conditions affecting performance.

- 1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
- 2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
- 3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- 4. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Existing Utility Information: Furnish information to local utility or University, as appropriate, that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect/Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

- A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Architect/Engineer promptly.
- B. General: Engage a land surveyor or professional engineer to lay out the Work using accepted surveying practices.
 - 1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
 - 2. Establish limits on use of Project site.
 - 3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
 - 4. Inform installers of lines and levels to which they must comply.
 - 5. Check the location, level and plumb, of every major element as the Work progresses.
 - 6. Notify Architect/Engineer when deviations from required lines and levels exceed allowable tolerances. Record deviation which are accepted (i.e., not corrected) on record drawings in accordance with the requirements of Section 01 78 39 "Project Record Documents."
 - 7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.
- E. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect/Engineer.

3.4 FIELD ENGINEERING

- A. Identification: University will identify existing benchmarks, control points, and property corners.
- B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
 - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Architect/Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect/Engineer before proceeding.
 - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- C. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
 - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
 - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
 - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.
- D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.
- E. Final Property Survey: Engage a land surveyor or professional engineer to prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor or professional engineer, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 - 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 - 2. Recording: At Substantial Completion, have the final property survey recorded by or with authorities having jurisdiction as the official "property survey."

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 - 1. Make vertical work plumb and make horizontal work level.
 - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 - 3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
 - 4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated to the extent they are more explicit or stringent than requirements of the Contract Documents.
- C. Install products at the time and under conditions, including weather that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Isolate each part of complete installation from incompatible material as needed to prevent deterioration.
- E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- F. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- G. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- H. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- I. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned, true and level as applicable, with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- J. Attachment to Concrete:
 - 1. No drilled inserts or powder-actuated fasteners are permitted in pre-stressed concrete except as specifically authorized by Contractor and carried out under the direct supervision of its Superintendent.
 - 2. Only those devices with a maximum controlled penetration of 3/4 inch or less will be permitted. Make holes through slabs by means of sleeves placed no closer than 2 inch from tensioning cables.

Core drilling will not be permitted unless unavoidable and as specified for cutting and patching in this Section.

- K. Joints: Unless indicated otherwise, make joints of uniform width. Where joint locations in exposed work are required but not indicated, arrange joints for the best visual effect. Confirm arrangement with Architect/Engineer before proceeding. Fit exposed connections together to form hairline joints.
- L. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Responsibility: Provide cutting and patching work, including attendant excavation and backfill required to complete the Work or to:
 - 1. Make components fit together properly.
 - 2. Uncover portions of the Work to provide for installation of ill-timed work.
 - 3. Remove and replace defective work or work not conforming to requirements of Contract Documents.
 - 4. Remove samples of installed work as specified for testing.
 - 5. Provide routine penetrations of non-structural surfaces for installation of piping and electrical conduit.
- C. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- D. Temporary Support: Provide temporary support of work to be cut.
- E. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- F. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."
- G. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."
- H. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

- 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
- 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
- 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
- 4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations. Employ methods which will prevent settlement or damage to other work.
- 5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
- 6. Proceed with patching after construction operations requiring cutting are complete.
- I. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements, including tolerance, specified in other Sections, where applicable.
 - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
 - 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 - 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - 4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
 - 5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.
- J. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 UNIVERSITY-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for University's construction personnel.
- B. Coordination: Coordinate construction and operations of the Work with work performed by University's construction personnel.

- 1. Construction Schedule: Inform University of Contractor's preferred construction schedule for University's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify University if changes to schedule are required due to differences in actual construction progress.
- 2. Preinstallation Conferences: Include University's construction personnel at preinstallation conferences covering portions of the Work that are to receive University's work. Attend preinstallation conferences conducted by University's construction personnel if portions of the Work depend on University's construction.

3.8 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold waste materials more than seven calendar days during normal weather or three calendar days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 - a. Use containers intended for holding waste materials of type to be stored.
- B. Collection Point: Review location with University and obtain approval.
- C. Site: Maintain Project site free of waste materials and debris.
- D. Wind Blown Debris: Prevent spread of trash, debris, cartons, packing material, or other waste on or off Project site by wind.
- E. Dust: Sprinkle dusty debris with water.
- F. Packing Materials: Immediately after uncrating or unpacking materials or equipment, remove all crating, lumber, excelsior, wrapping or other like combustible materials from building to central collection facility.
- G. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- H. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- I. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- J. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

- K. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."
- L. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- M. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- N. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.
- O. Snow and Ice: Remove snow and ice from sidewalks adjacent to site and from access ways to building and construction site.
- P. Streets: At frequency required by University and/or governing authority, clean adjacent and nearby streets of dirt resulting from construction operations.

3.9 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.10 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following:
 - 1. Excessive static or dynamic loading.
 - 2. Excessive internal or external pressures.
 - 3. Excessively high or low temperatures.
 - 4. Thermal shock.

- 5. Excessively high or low humidity.
- 6. Air contamination or pollution.
- 7. Water or ice.
- 8. Solvents.
- 9. Chemicals.
- 10. Light.
- 11. Radiation.
- 12. Puncture.
- 13. Abrasion.
- 14. Heavy traffic.
- 15. Soiling, staining and corrosion.
- 16. Bacteria.
- 17. Rodent and insect infestation.
- 18. Combustion.
- 19. Electrical current.
- 20. High speed operation.
- 21. Improper lubrication.
- 22. Unusual wear or other misuse.
- 23. Contact between incompatible materials.
- 24. Misalignment.
- 25. Excessive weathering.
- 26. Unprotected storage.
- 27. Improper shipping or handling.
- 28. Theft.
- 29. Vandalism.

END OF SECTION 01 73 00

SECTION 01 73 05

UTILITY INTERRUPTION - MECHANICAL, ELECTRICAL, PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing the shutdown of mechanical, electrical, and plumbing services for proper notification of all impacted by shutdown.
- B. Contractor to complete attached outage request and submit to university project manager.
- C. Outage requests must be submitted in advance per the time periods identified on attached form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 COORDINATION

- A. University staff will coordinate and announce internally to all impacted areas.
- B. Contractor & Subcontractors requesting outages must be present at specified time identified in approved outage request to initiate the start of outage. If contractors are not present, outage may be postponed.
- C. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

END OF SECTION 01 73 05



Facilities Management

UTILITY INTERRUPTION/ SHUTDOWN REQUEST FORM INSTRUCTIONS

- 1. Starting on page 2, fill out all necessary information on the Utility Interruption/ Shutdown Request Form.
- 2. On page 3, fill out all necessary information on the Utility Interruption/ Shutdown Method of Procedure.
- 3. Utility Interruption/ Shutdown Request Forms can only be submitted to the Outage Coordinator by a University Representative. All others will be returned to sender.
- 4. Contractors submit your request to your University Project Manager, not the contracts listed below.
 - **a.** Submit the Utility Interruption/ Shutdown Request Form and the Utility Interruption/ Shutdown Method of Procedure to:

Jesse.Walklett@CUAnschutz.edu Cc... heath.dejager@cuanschutz.edu

newman.forrester@cuanschutz.edu

- 5. Requests for minor outages (determined by severity of impact) must be submitted to the Outage Coordinator seven (7) working days prior to the requested start date.
- 6. Requests for major outages (determined by severity of impact) must be submitted to the Outage Coordinator thirty (30) working days prior to the scheduled outage.
- 7. After receiving both the Utility Interruption/ Shutdown Request Form and the Utility Interruption/ Shutdown Method of Procedure, the Outage Coordinator will create an outage file and begin coordinating the request.
- 8. After the outage has been successfully coordinated, the request will be submitted for approval.
- 9. After the outage has been approved, the Outage Coordinator will send out the approved outage notice, create a meeting reminder for Facilities Staff, and send out the MOP followed by a Campus Announcement.

When an Outage is requested without the benefit of the minimum advance notice (7 days for a minor outage - 30 days for a major outage), <u>the Outage Coordinator will request that the Project</u> <u>Manager and Contractor still submit an adequate Method of Procedure (MOP) for the outage</u>. The requester will be responsible for distributing notices to the occupants of any and all affected area(s). The requester will also distribute a copy of the Outage Posting and a copy of the MOP to the Contractor and/or person performing the outage. The requester will then send, via email, the names of all the people they have distributed notices to, as confirmation to the Outage Coordinator. <u>ANY AND ALL DISPUTES WITH THE OCCUPANTS OF THE AFFECTED AREA(S) WILL BE RESOLVED BY THE REQUESTER.</u>

In case of an EMERGENCY, contact the CSC at 303-724-1777



Facilities Management

UTILITY INTERRUPTION/ SHUTDOWN REQUEST FORM

Utility or Service Requesting to be Interrupted or Shutdown	
Affected Areas (Building & Room Numbers)	
Outage Requester (Name & Phone Number)	
Requested Start Time & Start Date	Time: Date:
Anticipated Finish Time & Finish Date	Time: Date:
University Project Manager (Name & Phone Number)	
University Back-Up Project Manager (Name & Phone Number)	
Contractor (Name & Phone Number)	
Sub-Contractor (Name & Phone Number)	
Facilities Management Building Representative (Name & Phone Number)	
Maximo Work Order Number or Project Number	
Additional Assistance Required? (Check All Required) *Facilities Maintenance Use Only*	Zone Staff Electrical Staff Plumbing Staff HVAC Staff Shift Staff Other (Who?)

Completely fill out the Method of Procedure section on page 3.

A missing or incomplete MOP will result in an automatic denial of the outage request.



Facilities Management

UTILITY INTERRUPTION/ SHUTDOWN METHOD OF PROCEDURE

Clearly list all necessary actions in a step-by-step format that will be required for completion of this request.

Additional Notes:

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SECTION 01 73 06

UTILITY INTERRUPTION – FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements governing the shutdown of fire protection systems for proper notification of all impacted by shutdown.
- B. Contractor to complete attached outage request and submit to university project manager.
- C. Outage requests must be submitted in advance per the time periods identified on attached form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 COORDINATION

- A. University staff will coordinate and announce internally to all impacted areas.
- B. Contractor & Subcontractors requesting outages must be present at specified time identified in approved outage request to initiate the start of outage. If contractors are not present, outage may be postponed.
- C. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

END OF SECTION 01 73 06

University of Colorado Denver Fire Protection System Impairment Request Form

(See instructions and additional information on pages 2 & 3)

All impairments, as a result of preplanned or emergency conditions, shall be inspected prior to generating the request to evaluate affected and unaffected areas. CU Project Manager, Fire & Life Safety, or BMO Rep. will submit this form.

IMPAIRMENT LOCATION/CONTACTS:

Project Location:		
Permit# or PN#: (Mark "N/A" if work is done in house)		
Requestor-UCD PM or BMO Supervisor:		
Email Address:	Mobile #:	
Contractor:	Office #:	
Jobsite Supervisor Name:	Mobile #:	
Fire Alarm/Sprinkler Contractor:	Mobile #:	
PRE-PLANNED IMPAIRMENT:		
Date(s): to Fi	ire Protection System Test? Yes 🚺 No 🚺	
Time(s): to 0	utside normal hours? Yes 🚺 No 🚺	
Fire Protection system devices to be added/deleted/moved? Yes 🦳 No 🌔		
IMPAIRMENT DETAILS:		
Device(s)/Component(s)/Function(s) to be impaired:		
Reason for impairment (work being performed):		
Method of fire alarm impairment(s): (To be completed by Fire & Life Safety prior to Approval)		
Method of fire suppression impairment(s): (To be completed by Fire & Life Safety prior to Approval)		
Fire watch to be employed? Yes 🦳 No 🌅		
EMERGENCY IMP	AIRMENT:	
Describe emergency:		
COMMENTS:		

GENERAL INSTRUCTIONS

This form shall be used anytime a fire protection system (alarm or suppression), or portion thereof, is impaired as a result of pre-planned or emergency conditions, or if these systems could be impacted by dust or other adverse conditions related to construction activities. <u>This form must be submitted and distributed by the responsible CU Project Manager (PM), CU BMO Supervisor, CU Fire & Life Safety, or other CU representative.</u>

- All pre-planned impairments to be done between the hours of 6:00 AM and 3:30 PM, Monday through Friday, unless requestor has made prior arrangements with the Fire and Life Safety Supervisor. (Anschutz Campus), Facilities Management. (Denver Campus).
- 2. Impairment requests for non-testing must be submitted by e-mail before 12:00 PM of the business day prior to the date of the requested impairment.
- 3. Impairment requests for testing must be submitted by e-mail before 12:00 PM two business days prior to the date of the requested impairment.
- 4. If there is a special hazard system in the area of the requested impairment (computer room, FM 200 System, etc.) it is the responsibility of the person requesting the impairment to have that system disabled by the owner of the system before starting work and enabling the system after completing work.
- 5. If system additions are made, ensure that devices are labeled accordingly with 8-digit addresses to ensure all field devices coincide with Fire Alarm Control Panel and Graphic Map.
- 6. Noise related testing must be completed between 5:00am to 7:00am.

SEND COMPLETED OUTAGE REQUEST FORMS TO APPROPRIATE FIRE & LIFE SAFETY (ANSCHUTZ), FACILITIES MANAGEMENT(DENVER) FOR APPROVAL

Anschutz Medical Campus

AMCFIRESYSTEMOUTAGE@UCDENVER.EDU

Denver Campus

DDCFIRESYSTEMOUTAGE@UCDENVER.EDU

ADDITIONAL INFORMATION

Steps for **FIRE ALARM / FIRE SPRINKLER** impairment:

- 1. <u>IMPAIRMENT LOCATION/CONTACTS:</u> Use placard information outside room and complete all contact information, input N/A if doesn't apply
- 2. PRE-PLANNED IMPAIRMENT: Refer to general instructions above for guidelines
- IMPAIRMENT DETAILS: Locate devices in your area of work and input 8-digit address located on devices; provide details of work being performed. The rest will be completed by FLS.
- EMERGENCY IMPAIRMENT: In the case of an emergency, FLS will assist with completing impairment. FLS is always available to assist immediately; you can find our information on page 3.

Steps for FIRE ALARM impairment throughout a project:

- <u>Demo Impairment for Fire Alarm</u>: The intent of this impairment is for the fire alarm contractor to come in before the demo crew to safe off the existing system (existing wiring and devices). Then remove (deprogram) smoke detection, pull stations, speakers, strobes, etc.... leave minimal notification coverage and install temporary heat detection at the deck if the sprinkler system is going to be drained.
- <u>General Impairment for Fire Alarm</u>: The intent of this impairment is to support meetings, emergencies caused by construction activity, job walks to discuss existing, or additional support that cannot be provided by the GC.

- 3. <u>Tie-in / Program Impairment for Fire Alarm</u>: Project is almost complete; fire alarm contractor has passed the overhead inspection and the space has flooring and painting complete just working on final touches. Fire alarm contractor will come in and start connecting to the building system and program new devices. (This requires a lot of our time so we would prefer you narrow down the time as best as possible or provide details on the outage for your duration and in addition, give us a 12 24 hr. call before arrival so that we can adjust our schedules to support if the impairment is longer than a week.)
- Pre-Test / Final Impairment Fire Alarm: These can be combined if the pre-test and final are within the same week otherwise we prefer separate impairments for each test.
 - a. Typically combined with the fire sprinkler test.

Steps for FIRE SPRINKLER impairment throughout a project:

- <u>Demo Impairment for Fire Sprinkler</u>: Upon completion of demo impairment for fire alarm and confirmation of temporary heat detection, the sprinkler contractor with support from our fluid group can drain down system.
- <u>Re-Fill Impairment for Fire Sprinkler</u>: Project is almost complete; sprinkler contractor has passed the overhead inspection. Sprinkler contractor, with support from our fluid group, can then re-fill system.
- <u>Pre-Test / Final Impairment Fire Sprinkler</u>: These can be combined if the pre-test and final are within the same week otherwise we prefer separate impairments for each test.
 - a. Typically combined with the fire alarm test.

SYSTEM RESTORATION

Anschutz Medical Campus:

All fire protection system restorations shall be validated by the CU Fire & Life Safety for all affected impairments. Fire & Life Safety Supervisor and/or Campus Fire Marshall shall communicate applicable system restorations with local fire department and FM Global, as applicable to each impairment.

Denver Campus:

All fire protection system restorations shall be validated by Facilities Management and/or Code Official (possibly DFD) for all affected impairments and shall be communicated with local fire department and FM Global, as applicable to each impairment.

QUESTIONS AND CONTACTS

ANSCHUTZ MEDICAL CAMPUS FIRE & LIFE SAFETY:

Duxton Milam, Campus Fire Marshall: Mobile (720) 641-4490 Email: DUXTON.MILAM@CUANSCHUTZ.EDU

Tyler Dunlap, Fire Alarm Technician: Mobile: (720) 717-0560 Email: <u>TYLER.DUNLAP@CUANSCHUTZ.EDU</u> Mitch Brochu, Fire Alarm Technician: Mobile (720) 660-4431 Email: <u>MITCHELL.BROCHU@CUANSCHUTZ.EDU</u> Eric Bevins, Fire Alarm Technician: Mobile (720) 951-7039 Email: <u>ERIC.BEVINS@CUANSCHUTZ.EDU</u> Mark Beall, Fire Sprinkler Systems: Mobile: (720) 951-3364 Email: <u>MARK.BEALL@CUANSCHUTZ.EDU</u>

DOWNTOWN DENVER CAMPUS:

Keith Lemieux, Facilities Management: Mobile: (303) 591-6993 Email: <u>BYRON.LEMIEUX@UCDENVER.EDU</u>

Updated: 10/01/19

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Salvaging nonhazardous demolition and construction waste.
 - 2. Recycling nonhazardous demolition and construction waste.
 - 3. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 02 41 19 "Selective Demolition" for disposition of waste resulting from partial demolition of buildings, structures, and site improvements.

1.3 DEFINITIONS

- A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.
- B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.
- C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.
- D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.
- E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.
- F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.4 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of minimum 75 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition

waste from landfills and incinerators. Facilitate recycling and salvage of materials, including the following:

- 1. Demolition Waste:
 - a. Asphalt paving.
 - b. Concrete.
 - c. Concrete reinforcing steel.
 - d. Brick.
 - e. Concrete masonry units.
 - f. Wood studs.
 - g. Wood joists.
 - h. Plywood and oriented strand board.
 - i. Wood paneling.
 - j. Wood trim.
 - k. Structural and miscellaneous steel.
 - l. Rough hardware.
 - m. Roofing.
 - n. Insulation.
 - o. Doors and frames.
 - p. Door hardware.
 - q. Windows.
 - r. Glazing.
 - s. Metal studs.
 - t. Gypsum board.
 - u. Acoustical tile and panels.
 - v. Carpet.
 - w. Carpet pad.
 - x. Demountable partitions.
 - y. Equipment.
 - z. Cabinets.
 - aa. Plumbing fixtures.
 - bb. Piping.
 - cc. Supports and hangers.
 - dd. Valves.
 - ee. Sprinklers.
 - ff. Mechanical equipment.
 - gg. Refrigerants.
 - hh. Electrical conduit.
 - ii. Copper wiring.
 - jj. Lighting fixtures.
 - kk. Lamps.
 - ll. Ballasts.
 - mm. Electrical devices.
 - nn. Switchgear and panelboards.
 - oo. Transformers.
- 2. Construction Waste:
 - a. Masonry and CMU.
 - b. Lumber.
 - c. Wood sheet materials.
 - d. Wood trim.
 - e. Metals.
 - f. Roofing.
- g. Insulation.
- h. Carpet and pad.
- i. Gypsum board.
- j. Piping.
- k. Electrical conduit.
- 1. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:
 - 1) Paper.
 - 2) Cardboard.
 - 3) Boxes.
 - 4) Plastic sheet and film.
 - 5) Polystyrene packaging.
 - 6) Wood crates.
 - 7) Plastic pails.

1.5 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 calendar days of date established for the Notice to Proceed.

1.6 INFORMATIONAL SUBMITTALS

- A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste, as applicable. Include the following information:
 - 1. Material category.
 - 2. Generation point of waste.
 - 3. Total quantity of waste in tons.
 - 4. Quantity of waste salvaged, both estimated and actual in tons.
 - 5. Quantity of waste recycled, both estimated and actual in tons.
 - 6. Total quantity of waste recovered (salvaged plus recycled) in tons.
 - 7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.
- F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

- G. LEED Submittal: LEED letter template for "Construction and Demolition Debris Management Planning" credit, signed by Contractor, tabulating total waste material, quantities diverted and means by which it is diverted, and statement that requirements for the credit have been met.
- H. Qualification Data: For refrigerant recovery technician.
- I. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.7 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.
- C. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:
 - 1. Review and discuss waste management plan including responsibilities of waste management coordinator.
 - 2. Review requirements for documenting quantities of each type of waste and its disposition.
 - 3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
 - 4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
 - 5. Review waste management requirements for each trade.

1.8 WASTE MANAGEMENT PLAN

- A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Where Project includes demolition, distinguish between demolition and construction waste. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.
- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste, as applicable, generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
 - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
 - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.

- 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
- 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
- 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
- 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

- A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
 - 1. Comply with operation, termination, and removal requirements in Section 01 50 00 "Temporary Facilities and Controls."
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Based on Project size and complexity, waste management coordinator may, if approved in writing by Architect/Engineer and University Project Manager, serve in other construction related roles.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.
 - 1. Distribute waste management plan to everyone concerned within three business days of submittal return.
 - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
 - 1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
 - 2. Comply with Section 01 50 00 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

- A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:
 - 1. Clean salvaged items.

- 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
- 3. Store items in a secure area until installation.
- 4. Protect items from damage during transport and storage.
- 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- B. Salvaged Items for Sale and Donation: Not permitted on Project site.
- C. Salvaged Items for University's Use: Salvage items for University's use and handle as follows:
 - 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
 - 3. Store items in a secure area until delivery to University.
 - 4. Transport items to University's storage area designated by University.
 - 5. Protect items from damage during transport and storage.
- D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.
- E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
- F. Plumbing Fixtures: Separate by type and size.
- G. Lighting Fixtures: Separate lamps by type and protect from breakage.
- H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.
- C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.
- D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.
 - 1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - a. Inspect containers and bins for contamination and remove contaminated materials if found.

- 2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- 3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
- 4. Store components off the ground and protect from the weather.
- 5. Remove recyclable waste from University's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

- A. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
- B. Metals: Separate metals by type.
 - 1. Structural Steel: Stack members according to size, type of member, and length.
 - 2. Remove and dispose of bolts, nuts, washers, and other rough hardware.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
- D. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
- E. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.
- F. Carpet and Pad: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - 1. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- G. Carpet Tile: Remove debris, trash, and adhesive.
 - 1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
- H. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
- I. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

- A. Packaging:
 - 1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - 2. Polystyrene Packaging: Separate and bag materials.
 - 3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - 4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

- B. Wood Materials:
 - 1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - 2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
- C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.
 - 1. Clean Gypsum Board: If gypsum board is processed on site, grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding. At Contractor's option, processing may occur off site.

3.6 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
 - 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from University's property and legally dispose of them.

3.7 ATTACHMENTS

- A. Form CWM-1 for construction waste identification.
- B. Form CWM-2 for demolition waste identification.
- C. Form CWM-3 for construction waste reduction work plan.
- D. Form CWM-4 for demolition waste reduction work plan.
- E. Form CWM-7 for construction waste reduction progress report.
- F. Form CWM-8 for demolition waste reduction progress report.

END OF SECTION 01 74 19

EVALUATIONS APPENDIX A

FORM CWM-1: CONSTRUCTION WASTE IDENTIFICATION							
MATERIAL CATEGORY	GENERATION POINT	EST. QUANTITY OF MATERIALS RECEIVED* (A)	EST. WASTE - % (B)	TOTAL EST. QUANTITY OF WASTE* (C = A x B)	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

* Insert units of measure.

EVALUATIONS APPENDIX B

FORM CWM-2: DEMOLITION WASTE IDENTIFICATION								
MATERIAL DESCRIPTION	EST. QUANTITY	EST. VOLUME CY (CM)	EST. WEIGHT TONS (TONNES)	REMARKS AND ASSUMPTIONS				
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Piping Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices	1							
Switchgear and Panelboards								
Transformers								
Other:								

EVALUATIONS APPENDIX C

	FORM CWM-3: CONSTRUCTION WASTE REDUCTION WORK PLAN						
		TOTAL EST.	DISI	POSAL METHOD AND Q	UANTITY		
MATERIAL CATEGORY	GENERATION POINT	QUANTITY OF WASTE TONS (TONNES)	EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	HANDLING AND TRANSPORTION PROCEDURES	
Packaging: Cardboard							
Packaging: Boxes							
Packaging: Plastic Sheet or Film							
Packaging: Polystyrene							
Packaging: Pallets or Skids							
Packaging: Crates							
Packaging: Paint Cans							
Packaging: Plastic Pails							
Site-Clearing Waste							
Masonry or CMU							
Lumber: Cut-Offs							
Lumber: Warped Pieces							
Plywood or OSB (scraps)							
Wood Forms							
Wood Waste Chutes							
Wood Trim (cut-offs)							
Metals							
Insulation							
Roofing							
Joint Sealant Tubes							
Gypsum Board (scraps)							
Carpet and Pad (scraps)							
Piping							
Electrical Conduit							
Other:							

	FORM CWM-4: DEMOLITION WASTE REDUCTION WORK PLAN					
		TOTAL EST	DISP	OSAL METHOD AND Q	UANTITY	
MATERIAL CATEGORY	GENERATION POINT	QUANTITY OF WASTE TONS (TONNES)	EST. AMOUNT SALVAGED TONS (TONNES)	EST. AMOUNT RECYCLED TONS (TONNES)	EST. AMOUNT DISPOSED TO LANDFILL TONS (TONNES)	HANDLING AND TRANSPORTION PROCEDURES
Asphaltic Concrete Paving						
Concrete						
Brick						
CMU						
Lumber						
Plywood and OSB						
Wood Paneling						
Wood Trim						
Miscellaneous Metals						
Structural Steel						
Rough Hardware						
Insulation						
Roofing						
Doors and Frames						
Door Hardware						
Windows						
Glazing						
Acoustical Tile						
Carpet						
Carpet Pad						
Demountable Partitions						
Equipment						
Cabinets						
Plumbing Fixtures						
Piping						
Supports and Hangers						
Valves						
Sprinklers						
Mechanical Equipment						
Electrical Conduit						
Copper Wiring						
Light Fixtures						
Lamps						
Lighting Ballasts						
Electrical Devices						
Switchgear and Panelboards						
Transformers						
Other:						

EVALUATIONS APPENDIX G

	FORM CWM-7: CONSTRUCTION WASTE REDUCTION PROGRESS REPORT							
		ΤΟΤΑΙ	QUANTITY OF W	ASTE SALVAGED	QUANTITY OF W	ASTE RECYCLED	TOTAL	TOTAL
MATERIAL CATEGORY	GENERATION POINT	QUANTITY OF WASTE TONS (TONNES) (A)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)	QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	QUANTITY OF WASTE RECOVERED % (D / A x 100)
Packaging: Cardboard								
Packaging: Boxes								
Packaging: Plastic Sheet or Film								
Packaging: Polystyrene								
Packaging: Pallets or Skids								
Packaging: Crates								
Packaging: Paint Cans								
Packaging: Plastic Pails								
Site-Clearing Waste								
Masonry or CMU								
Lumber: Cut-Offs								
Lumber: Warped Pieces								
Plywood or OSB (scraps)								
Wood Forms								
Wood Waste Chutes								
Wood Trim (cut-offs)								
Metals								
Insulation								
Roofing								
Joint Sealant Tubes								
Gypsum Board (scraps)								
Carpet and Pad (scraps)								
Piping								
Electrical Conduit								
Other:								

EVALUATIONS APPENDIX H

FORM CWM-8: DEMOLITION WASTE REDUCTION PROGRESS REPORT								
			OUANTITY OF W	ASTE SALVAGED	ALVAGED OUANTITY OF WASTE RECYCLED		TOTAL	TOTAL
MATERIAL CATEGORY	GENERATION POINT	TOTAL QUANTITY OF WASTE TONS (TONNES) (A)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (B)	ESTIMATED TONS (TONNES)	ACTUAL TONS (TONNES) (C)	QUANTITY OF WASTE RECOVERED TONS (TONNES) (D = B + C)	QUANTITY OF WASTE RECOVERED % (D / A x 100)
Asphaltic Concrete Paving								
Concrete								
Brick								
CMU								
Lumber								
Plywood and OSB								
Wood Paneling								
Wood Trim								
Miscellaneous Metals								
Structural Steel								
Rough Hardware								
Insulation								
Roofing								
Doors and Frames								
Door Hardware								
Windows								
Glazing								
Acoustical Tile								
Carpet								
Carpet Pad								
Demountable Partitions								
Equipment								
Cabinets								
Plumbing Fixtures								
Piping								
Supports and Hangers								
Valves								
Sprinklers								
Mechanical Equipment								
Electrical Conduit								
Copper Wiring								
Light Fixtures								
Lamps								
Lighting Ballasts								
Electrical Devices								
Switchgear and Panelboards								
Transformers								
Other:								

SECTION 01 77 00

CLOSEOUT PROCEDURES

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures, including Notice of Completion and Final Inspection procedures.
 - 2. Occupancy procedures, including Notice of Approval of Occupancy/Use and University Supplemental Notice of Occupancy and Use List.
 - 3. Final Acceptance procedures, including Pre-Acceptance Checklist and University Supplemental Building/Project Acceptance List.
 - 4. Inspections after completion.
 - 5. Warranties.
 - 6. Final cleaning.
 - 7. Repair of the Work.
- B. Related Requirements:
 - 1. Section 01 32 33 "Photographic Documentation" for submitting final completion construction photographic documentation.
 - 2. Section 01 73 00 "Execution" for progress cleaning of Project site.
 - 3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 01 79 00 "Demonstration and Training" for requirements for instructing University's personnel.

1.3 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Notice of Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Acceptance.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

- B. Certificate of Insurance: For continuing coverage.
- C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 NOTICE OF COMPLETION AND SUBSTANTIAL COMPLETION PROCEDURES

- A. Procedures and Submittals Prior to Notice of Completion: Complete and submit all of the following items prior to submitting Notice of Completion to Architect/Engineer. Include Contractor's comprehensive list of items to be completed, corrected or not in compliance with the Drawings and Specifications.
 - 1. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's preliminary punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
 - 2. Building Inspection Record: Submit completed record with all required corrections noted.
 - 3. Certificate of Occupancy: Submit Certificate of Occupancy (CO) or Temporary Certificate of Occupancy (TCO).
 - 4. Final Completion Schedule: Submit schedule for performing and completing all work indicated on the Contractor' list of incomplete items.
 - 5. Submit sustainable design documentation.
 - 6. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 7. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 8. Submit test/adjust/balance records.
- B. Final Inspection: Submit Notice of Completion to Architect/Engineer. Upon receipt, Architect/Engineer and University will review and if all items on the University Supplemental Notice of Completion Checklist are complete will, within the timeframe required by the Contract, schedule and make an inspection of the Project to determine whether the Work is substantially complete.
 - 1. Final Punch List: Based on the inspection, Architect/Engineer will prepare a final punch list of work to be completed, work not in compliance with the Drawings or Specifications, and unsatisfactory work for any reason.
 - 2. Re-inspection: If the cumulative number of items identified on the final punch list prevents a determination that the work is substantially complete, complete those items and when complete resubmit Notice of Completion. Upon receipt of resubmittal, Architect/Engineer and University will then schedule and make a re-inspection of the Project to determine whether the Work is substantially complete.
- C. Notice of Substantial Completion: When inspection of the Work indicates that the Project is substantially complete and all other Contract provisions required for substantial completion have been satisfied, Architect/Engineer will issue a Notice of Substantial Completion (State Form SBP-07).

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 - 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor or as approved by Architect/Engineer.
 - 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 - 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect/Engineer.
 - d. Name of Contractor.
 - e. Page number.
 - 4. Submit list of incomplete items in the following format:
 - a. MS Excel and PDF electronic file. Architect/Engineer will return annotated file.

1.8 OCCUPANCY PROCEDURES

A. Procedures and Submittals Prior to Occupancy: Complete and submit all items on both State Form SBP-01 "Notice of Approval of Occupancy/Use" and University Supplemental Notice of Occupancy and Use List.

1.9 FINAL ACCEPTANCE PROCEDURES

- A. Procedures and Submittals Prior to Final Acceptance: Complete and submit all items on both State Form SBP-05 "Pre-Acceptance Checklist" and University Supplemental Building/Project Acceptance List.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 business days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect/Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect/Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
 - 1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.10 SETTLEMENT AND FINAL PAYMENT

- A. Submit and complete all of the following as a condition precedent to settlement and final payment:
 - 1. All guarantees and warranties.
 - 2. All statement to support local sales tax refunds, if any.
 - 3. Three (3) sets of operation and maintenance manuals.
 - 4. One (1) set of as-built Contract Documents showing all job changes.

- 5. All demonstration and training completed in accordance with Section 01 79 00.
- 6. All punch list items documented as complete.
- B. Final Certificate of Payment: Submit in accordance with the requirements of Section 01 29 00 "Payment Procedures."

1.11 INSPECTIONS AFTER COMPLETION

- A. Warranty/Guarantee Inspections: During the warranty period, accompany Architect/Engineer and University Representative, and participate in inspection(s) of the Project to identify defective and deficient work at intervals and as required by the Contract.
- B. List of Deficient or Defective Work: Within 10 business days of inspection, Architect/Engineer will provide Contractor with a list of items requiring correction.
- C. Remedial Work: Upon receive of itemized list, immediately correct and remedy deficiencies and defects in a manner satisfactory to the Architect/Engineer and University.

1.12 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties to the Architect/Engineer prior to advertisement of the Notice of Contractor's Settlement. If the Notice of Acceptance designates a commencement date for warranties other than the date of Notice of Acceptance for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
- B. Partial Occupancy: When a designated portion of the Work is completed and occupied or used by the University, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect/Engineer within fifteen (15) calendar days of completion of that designated portion of the Work.
- C. Special Warranties: When a special warranty is required to be executed by the Contractor, or the Contractor and a Subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the University through the Architect/Engineer for approval prior to final execution. Refer to individual Specification Sections for specific requirements for special warranties.
- D. Form of Submittal: Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 - 1. Number of Copies: Two.
 - 2. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 3. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 4. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 5. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- E. Provide additional copies of each warranty to include in operation and maintenance manuals.

F. List of Extended Warranties: Provide a comprehensive list of all manufacturers' standard and special warranties with duration greater than one year after Notice of Acceptance. Organize list into an orderly sequence based on table of contents of the Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
 - 1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.
 - 2. Do not use sweeping compounds on concrete floors that will leave residue affecting finish floor materials.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations immediately prior to Occupancy for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Clean exposed exterior and interior finishes to a dirt-free condition, free of grease, dust, stains, films, fingerprints, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - h. Sweep concrete floors broom clean in unoccupied spaces.
 - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
 - j. Power scrub and power buff resilient flooring surfaces, tile and fluid-applied flooring.

- k. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
- l. Remove labels that are not permanent.
- m. Wipe surfaces of mechanical and electrical equipment, elevator equipment where applicable, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
- n. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
- o. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
- p. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
 - 1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
- q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
- r. Clean food service equipment to sanitary condition acceptable for intended food service use and approved by authority having jurisdiction.
- s. Leave Project clean and ready for occupancy.
- C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.
 - 1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
 - 2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
 - 3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
 - 4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

3.3 ATTACHMENTS

- A. Samples of the following forms are appended to this Section for reference following End of Section 01 77 00:
 - 1. University of Colorado Denver | Anschutz Medical Campus Supplemental Notice of Occupancy and Use List.
 - 2. University of Colorado Denver | Anschutz Medical Campus Supplemental Building / Project Acceptance List.

END OF SECTION 01 77 00



Supplemental Notice of Occupancy and Use List

Project Name & Number: Fitz Bldg Grnd NG015, NG016 Reno / PN 23-1183916

Contractor: _

In addition to completing Notice of Approval of Occupancy / Use (SBP-01), the following items must be completed before Occupancy is approved.

Activity	Date Completed	Remarks
1. Final and formal address posted on the building entries.		
2. A copy of the Contractor's in-progress red line "as-built" drawings has been given to BMO representative & a 2 nd copy is provided for Projects plan room. This is to include landscape drawings showing irrigation installation.		
3. Maintenance, operations and spare parts manuals on all installed equipment.		
4. Notice of Partial Substantial Completion concerning roles/ responsibilities of University and Contractor for security, maintenance, heat, utilities reviewed and accepted.		
5. Manufacturer maintenance, operations and spare parts manuals for fixtures, mechanical, electrical and plumbing.		
6. Hardware-maintenance, operations and spare parts manuals for doors & locks, including roll up doors.		
7. Warranty Dates and Contact list for all Contractors and Suppliers given to BMO.		
8. Transfer utility account from Contractor to Facilities Operations.		
9. Site plan to include first floor main isolation locations and plans for each floor to include main utility shutoffs, for utilities to include water, electrical, steam, sewer, fuel supply, telecom, fiber optic and gasses, identified on a set of drawings.		
10. If Commissioning Report is completed, BMO has reviewed/ commented, including electrical, plumbing, mechanical/ HVAC.		
11. All Contractor provided equipment has new filters & construction filters removed.		
12. Not Used		
13. Elevator equipment rooms insulated and space conditioned for control system requirements.		
14. Testing Certifications provided to BMO for Elevators, Fire Systems & Annunciator Systems.		
15. FSS has been provided with copy of Building Department testing and inspection report for window washing equipment.		
16. Roof walking pads to access equipment are installed.		
17. PM to communicate to fire department via Life Safety Officer that building has transitioned to BMO. Alarms at Anschutz Medical Campus report to University Police Dispatch and at Downtown report to designated monitoring company.		

18. BAS System (Siemens), Energy and Lighting, Fuel Systems, and Power Management must report remotely & verify with University - Engineering.	
19. Training for BMO and FSS on installed equipment and systems is completed.	
20. Equipment keys and locks transitioned to Operations, including fire panels, electrical panels, directories and generator panels. Construction cores removed and replaced with permanent cores.	
21. Access control pathways and junction boxes for installed doors, gates, loading docks and roof access complete. <u>*All wiring and hardware completed and</u> <u>electronic security access controls in place and tested by University Electronic Security.</u>	
22. EH&S is provided, as applicable for project, with fume hood certification, water testing certification, hazardous waste compliance certification, radiation compliance certification, BSL3 certification, and all other specialty equipment certification.	
23. PM notifies University Risk Management that project is transferring to University and notifies Contractor that it can eliminate Builders Risk Insurance.	
24. Not Used	
25. Not Used	
26. Elevator tools, including hand tools, computer, proprietary and operational software is received and confirm 1-year service from date of acceptance.	
27. All computers and software required in drawings and specs. are received, including for BAS, Energy and Lighting, Fuel Systems, and Power Management, and any specialty software and alarm codes for operating systems.	
28. For all areas to be transferred to University, all waste and debris removed; floor and wall surfaces clean and in good repair; ceiling surfaces clean, unmarked, in place; site, including sidewalks, cleared of debris and construction equipment; and roof is clear of all materials and debris.	
29. Water chlorination and testing complete and provided by PM to Chief Building Official and BMO via BMO Rep.	
30. Toilet accessories are in place that meet custodial contract.	
31. Trash receptacles outside the building are in place	

University Project Manager (sign & print name)	Date	University BMO Rep. (sign & print name)	Date
University FSS Rep (sign & print name)	Date	University Downtown Rep. (If Necessary) (sign & print name)	Date

*Highlighted items are not the responsibility of Contractor but PM and BMO Rep must ensure these are completed and operational prior to occupancy and use. Mark N/A by item if it is not applicable to project 3.1.12



Supplemental Building / Project Acceptance List

Project Name & Number: Fitz Bldg Grnd NG015, NG016 Reno / PN 23-1183916

Contractor: _

In addition to completing Pre-Acceptance Checklist (SBP-05), the following items must be completed before Final Acceptance.

Activity	Date Completed	Remarks
1. Review State Buildings Pre-Acceptance check list & Notice of Approval of Occupancy / use form with BMO rep & confirm agreement with status		
*2. Establish list of post construction change orders & track separately from basic		
project until items are complete – call it Phase 2 to avoid delay on basic project		
3. O & M Manuals given to BMO Representative and BMO Archivist (2 hard copies and 1 electronic total)		
*4. Record Documents – a hard copy of plans and specifications are provided for plan room & given to BMO & electronic auto cad & specs are given to Archive Officer (Art Steinman) this is to include landscape drawings showing irrigation installation.		
*5. Final Site Walk is completed with University Grounds Supervisor. Drain barriers are removed and storm drains cleared. MS4 storm water plan, CDPHE permits, and evidence of final closeout received by Project Manager and all copied to University Engineering Division.		
*/**6. <u>Move-related work items complete including physical move, tours</u> (occupants & police), mail, phone & electrical hook ups for equipment & furniture systems complete & freezers enrolled in University freezer program.		
7. If exterior work is applicable: Landscape – Include a walk through with University Grounds for 1) new & established 1-year service date; 2) existing damaged landscape is repaired; and 3) irrigation – zone control test is complete.		
8. Attic stock, matches spec. requirements, is located in secured location, and is inventoried.		
9. Electrical system one line diagram framed and mounted in electrical room.		
10. Spare fire suppression heads in cabinets and tool: cabinet in main electrical room includes one complete set of spare fuses for major equipment.		
11. Contractor keys issued by University BMO returned to University Key Shop via PM/ BMO Rep.		
12. Interior Finishes Binder given to the University Project Manager: (Two hard copies)		
13. Not Used		
14. Not Used		

15. Safety grating in pipe chases in place.	
16. Signs in place including monument sign, building exterior and site signage and building interior signage.	
17. All applicable reports, including Air Emission reports; Sewer Reports, including for process diverters, traps and collection tanks; Fuel Storage Tank and Detection reports; and Water System tests and reports provided to BMO via PM and BMO Rep.	
18. Not Used	
19. Not Used	
20. Not Used	
21. Not Used	
22. If commissioning is included for project, Commissioning Agent certification is received by BMO via PM and BMO Rep.	

University Project Manager (sign & print name)

Date

University BMO Rep. (sign & print name) Date

University FSS (sign & print name) Date

University Downtown Rep (if necessary) (sign & print name) Date

*Warranty dates are not subject to completion of these items by contract

** Highlighted items are not the responsibility of Contractor but PM and BMO Rep must ensure these are completed and operational prior to occupancy and use.

Mark N/A by item if it is not applicable to project 3.1.12

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Systems, subsystems, and equipment operation and maintenance manuals.
 - 3. Product maintenance manuals.
 - 4. Emergency manuals.
 - 5. Framed operating and maintenance instructions.
- B. Related Requirements:
 - 1. Section 01 33 00 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Section 01 91 13 "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

- A. Schedule: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 calendar days before commencing demonstration and training. Architect/Engineer will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect/Engineer's comments. Submit copies of each corrected manual within 15 calendar days of receipt of Architect/Engineer's comments and prior to commencing demonstration and training.
- B. Format: Submit operations and maintenance manuals in the following format:

- 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect/Engineer.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Compile entirely from documents with searchable text.
 - c. Enable inserted reviewer comments on draft submittals.
- 2. Paper copies. Assemble in accordance with the requirements of this Section.
 - a. Submit three final copies, one to be retained by the Architect/Engineer and two to be retained by the University.
- C. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 calendar days before commencing demonstration and training. Architect/Engineer will return copy with comments.
 - 1. Correct or revise each manual to comply with Architect/Engineer's comments. Submit copies of each corrected manual within 15 calendar days of receipt of Architect/Engineer's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 GENERAL REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Intent: Prepare data in form of an instructional manual for use by University personnel.
- B. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
 - 1. Title page.
 - 2. Table of contents.
 - 3. Manual contents.
- C. Title Page: Include the following information:
 - 1. Subject matter included in manual.
 - 2. Name and address of Project.
 - 3. Name and address of University.
 - 4. Date of submittal.
 - 5. Name and contact information for Contractor.
 - 6. Name and contact information for Construction Manager.
 - 7. Name and contact information for Architect/Engineer.
 - 8. Name and contact information for Commissioning Authority.
 - 9. Names and contact information for major consultants to the Architect/Engineer that designed the systems contained in the manuals.
 - 10. Cross-reference to related systems in other operation and maintenance manuals.
- D. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
 - 1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- E. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
- F. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
 - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- G. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

- H. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.
 - 1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size and enable OCR (optical character recognition) to provide searchable text.
 - 2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.
- I. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.
 - 1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in minimum 1 inch and maximum 2 inch thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.
 - 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 - 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
 - 4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20 lb., white bond paper.
 - 5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 SYSTEMS, SUBSYSTEMS AND EQUIPMENT OPERATION AND MAINTENANCE MANUALS

- A. General: Provide operation and maintenance manuals where indicated in individual Specification Section and the following:
 - 1. Heating, ventilating and air-conditioning equipment and systems.
 - 2. Plumbing equipment and systems.

- 3. Special piping equipment and systems.
- 4. Electrical distribution systems.
- 5. Standby generator systems.
- 6. Communications systems.
- 7. Fire alarm and detection systems.
- 8. Underground sprinkler systems.
- 9. Automatic entrances.
- 10. Food service equipment.
- 11. Elevators.
- 12. Other special construction and conveying systems.
- B. Operation Content: In addition to requirements in this Section, include operation data required in individual Specification Sections.
 - 1. Additional Operation Content Required:
 - a. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
 - b. Performance and design criteria if Contractor has delegated design responsibility.
 - c. Operating standards.
 - d. Operating procedures.
 - e. Operating logs.
 - f. Wiring diagrams.
 - g. Control diagrams.
 - h. Piped system diagrams.
 - i. Precautions against improper use.
 - j. License requirements including inspection and renewal dates.
 - 2. Descriptions: Include the following:
 - a. Product name and model number. Use designations for products indicated on Contract Documents.
 - b. Manufacturer's name.
 - c. Equipment identification with serial number of each component.
 - d. Equipment function.
 - e. Operating characteristics.
 - f. Limiting conditions.
 - g. Performance curves.
 - h. Engineering data and tests.
 - i. Complete nomenclature and number of replacement parts.
 - 3. Operating Procedures: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Instructions on stopping.
 - f. Normal shutdown instructions.
 - g. Seasonal and weekend operating instructions.
 - h. Required sequences for electric or electronic systems.
 - i. Special operating instructions and procedures.
 - 4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

- 5. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.
- C. Maintenance Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
 - 1. Source Information: Provide the following information in a list for each product included in manual:
 - a. Name, address, and telephone number of Installer or supplier and maintenance service agent.
 - b. Name, address, and telephone number of local source for supply of replacement parts.
 - c. Name, address, and telephone number of maintenance contractor, where appropriate.
 - d. Cross-reference Specification Section number and title.
 - e. Drawing or schedule designation or identifier where applicable.
 - 2. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - a. Standard maintenance instructions and bulletins.
 - b. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - c. Identification and nomenclature of parts and components.
 - d. List of items recommended to be stocked as spare parts.
 - 3. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - a. Test and inspection instructions.
 - b. Troubleshooting guide.
 - c. Precautions against improper maintenance.
 - d. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - e. Aligning, adjusting, and checking instructions.
 - f. Demonstration and training video recording, if available.
 - 4. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - b. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
 - 5. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
 - 6. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
 - 7. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - a. Include procedures to follow and required notifications for warranty claims.
b. Include information sheet covering proper procedures in event of failure and instances which might affect validity of warranties and bonds.

2.4 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Separate into two manuals: one for exterior moisture protection products and those exposed to weather and one for interior products. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: Provide the following information for each product included in manual:
 - 1. Name, address, and telephone number of Installer or supplier and maintenance service agent.
 - 2. Cross-reference Specification Section number and title.
 - 3. Drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.5 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
 - 1. Type of emergency.
 - 2. Emergency instructions.
 - 3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 - 1. Fire.

- 2. Flood.
- 3. Gas leak.
- 4. Water leak.
- 5. Power failure.
- 6. Water outage.
- 7. System, subsystem, or equipment failure.
- 8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of University's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
 - 1. Instructions on stopping.
 - 2. Shutdown instructions for each type of emergency.
 - 3. Operating instructions for conditions outside normal operating limits.
 - 4. Required sequences for electric or electronic systems.
 - 5. Special operating instructions and procedures.

2.6 FRAMED OPERATING AND MAINENANCE INSTRUCTIONS

- A. All mechanically and electrically operated equipment and controls shall be provided with legible and complete wiring diagrams, schematics, operating instructions, and pertinent preventative maintenance instructions in a sturdy frame with clear glass or plastic cover. Use non-fading, permanent media.
- B. Locate frames in the same room or service enclosure as equipment, or in the nearest mechanical or electrical room.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 78 23

SECTION 01 78 39

PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Record Samples.
 - 5. Miscellaneous record submittals.
- B. Related Requirements:
 - 1. Section 01 73 00 "Execution" for final property survey.
 - 2. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
 - 3. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

- A. General: Submit record drawings with duplicate original transmittal letters containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Certification that each document as submitted is complete and accurate.
 - 5. Signature of authorized representative of the Contractor.
- B. Record Drawings: Submit copies of record Drawings as follows:
 - 1. Submit three paper-copy sets of marked-up record prints, two copies will be retained by the University and one copy retained by the Architect/Engineer.
 - 2. Submit three paper-copy sets and three digital copies on CD of electronic files for all delegateddesign submittals. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

- C. Record Specifications: Submit three paper copies of Project's Specifications, including addenda and contract modifications. Two copies will be retained by the University and one copy retained by the Architect/Engineer.
- D. Record Product Data: Submit three paper copies of each submittal. Two copies will be retained by the University and one copy retained by the Architect/Engineer.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.
- E. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit three paper copies of each submittal. Two copies will be retained by the University and one copy retained by the Architect/Engineer.
- F. Interior Finishes Binder: Three copies. Two copies will be retained by the University and one copy retained by the Architect/Engineer.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - f. Mark using line types and symbols conforming to Contract Documents.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities referenced to permanent surface improvements.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities referenced to visible and accessible features of structure.

- j. Locations of concealed valves, dampers, controls, balancing devices, junction boxes, cleanouts, and other items requiring access or maintenance.
- k. Changes made by Change Order.
- 1. Changes made following Architect/Engineer's written orders.
- m. Details not on the original Contract Drawings.
- n. Field records for variable and concealed conditions.
- o. Record information on the Work that is shown only schematically.
- 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
- 4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
- 5. Mark additional information important to University that was either shown schematically or omitted from original Drawings.
- 6. Note Change Order numbers, and similar identification, where applicable.
- B. Record Delegated Design Electronic Files: For all delegated design submittals, including but not limited to landscape irrigation, fire alarm and fire sprinkler plans, prepare electronic files in full compliance with University of Colorado Denver | Anschutz Medical Campus Guidelines and Design Standards, Part 1.0, Paragraph "Drawing Production Standards."
- C. Identification: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
 - 1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 - 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect/Engineer.
 - e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to substitutions, selection of options, and similar information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Note related Change Orders where applicable.
 - 4. Maintain one complete copy of all Addenda, Change Orders and other written change documents in printed form during construction.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

- 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
- 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
- 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Directory: Include record Product Data directory organized by Specification Section number and title.
- C. Product List: Update and record any changes to Product List submitted in accordance with Section 01 60 00 "Product Requirements", including any changes to brand, model, subcontractor, or Installer so that final list reflects materials, equipment and systems incorporated into the Work.

2.4 RECORD SAMPLES

- A. Prior to Final Acceptance, meet with University Project Manager and Architect/Engineer at site to review and identify which submitted samples maintained during the progress of the Work are to be transmitted to the University.
- B. Deliver selected samples to storage area identified by University.
- C. Finishes Binder: Three-ring notebook or notebooks, organized by Specification Section number, providing a listing and description of all material finishes on the Project and including a minimum 6 inch by 6 inch sample thereof to accompany the description. Accompany each material selection indicated with the following:
 - 1. Manufacturer and product name.
 - 2. Pattern name and number, as applicable.
 - 3. Color name, as applicable.
 - 4. Any additional information required to order replacement product.

2.5 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
 - 1. Include manufacturer's certifications, field test record, copies of permits, licenses, certifications, inspection reports, releases, notices, receipts for fee payments and similar documents.
- B. Directory: Include miscellaneous record submittals directory organized by Specification Section number and title.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project. Update at least weekly.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect/Engineer's and University's reference during normal working hours.

END OF SECTION 01 78 39

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SECTION 01 78 46

EXTRA STOCK MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMETS

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

1.2 SUMMARY

A. Section includes descriptions and quantities of required extra stock materials.

1.3 INFORMATIONAL SUBMITTALS

- A. Schedule of Maintenance Materials: Prepare a schedule in tabular form of all extra stock materials required in individual Specification Sections including:
 - 1. Specification Section number and title.
 - 2. Description of required material
 - 3. Quantity of required material.

1.4 MAINTENANCE MATERIALS

- A. Furnish extra materials that match and are from the same production runs as the product installed.
- B. Provide in the quantities indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 MAINTENANCE MATERIAL SCHEDULE

SECTION	TITLE	DESCRIPTION	QUANTITY
09 30 00	TILING	Tile and Trim Units	Furnish 100 sq. ft. of full-size units for
			each type, composition, color, pattern, and
			size indicated.

09 51 23	ACOUSTICAL TILE CEILINGS	Acoustical Ceiling Units	100 sq. ft. of full-size tiles.
09 54 36	SUSPENDED DECORATIVE GRIDS	Suspended Decorative Grids	100 sq. ft. of each suspended decorative grid component, exposed molding, and trim.
09 65 13	RESILIENT BASE AND ACCESSORIES		Furnish 50 linear feet of each type, color, pattern, and size of wall base installed. Furnish 2% of each type, color, pattern, and size of all other resilient accessories installed.
09 68 13	TILE CARPETING	Carpet Tile	100 sq. ft. of full-size units for each type indicated.
21 05 00	FIRE SUPRRESION	Sprinkler heads and Special Sprinkler Wrenches.	2 heads minimum of each type and temperature rating installed and special sprinkler wrenches enclosed in a steel cabinet in accordance with NFPA 13.
22 30 00	PLUMBING EQUIPMENT	Valve Key	1 valve key for each key operated wall hydrant, post hydrant, hose bib, or faucet installed.
23 30 00	HVAC AIR DISTRIBUTION	Fire Dampers	3 fusible links per type installed.
26 09 43	NETWORK LIGHTING CONTROLS	Control Devices	3 devices for each device used.
26 20 00	LOW VOLTAGE ELECTRICAL DISTRIBUTION	Fuses	1 set of 3 of each type and size used on the project and fuse cabinet in main electrical room to hold them.
26 51 00	INTERIOR LIGHTING	Lamps	Provide 5% or a maximum of 25 spares of each lamp type used on the project.
28 31 00	FIRE DETECTION AND ALARM	Initiating and Control Devices	Provide 5 spare devices for each device type used.
		Notification Devices	Provide 5 spare devices for each device type used.

END OF SECTION 01 78 46

SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for instructing University's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.3 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include outline for each training module.
- B. Qualification Data: For instructor, demonstrating qualifications and ability to instruct on maintenance and care of system, equipment and products.
- C. Schedule of Demonstration and Training: Prepare a schedule in tabular form of all demonstration and training required in individual Specification Sections including:
 - 1. Specification Section number and title.
 - 2. Description of required demonstration and training.
- D. Attendance Record: For each training module, submit list of participants and length of instruction time.

1.4 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 01 40 00 "Quality Requirements," experienced in operation and maintenance procedures and training. Manufacturer's sales staff is not acceptable.
- B. Pre-instruction Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to demonstration and training.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.
- B. Training Modules: For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
 - 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
 - g. A tour of the installation identifying the location of all system components.
 - 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.

- k. Seasonal and weekend operating instructions.
- 1. Required sequences for electric or electronic systems.
- m. Special operating instructions and procedures.
- n. Sequence of operation.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
- 6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
- 7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
- 8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.
 - f. Product support/service model.
 - g. Purchasing of replacement parts.
- 9. Instruction specific to Instrumentation and Controls, Electrical Gateway, Network Lighting Controls, or any other new technology that is integrated with another system: Include the following:
 - a. Overview and theory.
 - b. Wiring diagrams, including the one line diagram.
 - c. Creation, editing, and programming of the point database.
 - d. Integration topology and platform for communication.
 - e. Graphics packages and touch screens for the system.
 - f. Alarms and diagnostics.
 - g. Reporting functions dynamically and historically.
 - h. Remote access to the system.
 - i. Database back-up and maintenance.
 - j. Replacement and re-programming of replacement parts.
 - k. Point type and functionality for each type of point.
 - l. Programming.
 - m. Point/object editing.
 - n. Loop tuning.

- o. Help files and other troubleshooting documentation.
- p. Instruction is given by the staff that setup the integration.
- C. Operation and Maintenance Manuals: Provide appropriate Operation and Maintenance manuals in each training session so that the detail drawings and maintenance activities are outlined and discussed for each application.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct University's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 - 1. University will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 - 1. Coordinate schedule for all training with University Project Manager and provide the following:
 - a. Minimum 3 weeks notification.
 - b. Training matrix in calendar format.
 - c. Training outline for each session.
 - 2. Do not schedule training until equipment has been started up, commissioned, and is currently operating in its normal condition.
 - 3. Do not schedule overlapping training sessions.
 - 4. Schedule training sessions for a maximum of 4 hours per day; afternoons preferred.
 - 5. Provide separate training session on each system for operational/maintenance groups and user groups.
 - 6. Training sessions will be cancelled and rescheduled unless the following documentation is received:
 - a. Instruction qualifications.
 - b. Evidence that equipment has been started up, commissioned, and is currently operating in its normal condition.
 - c. Operation and Maintenance manuals.
- C. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.
- D. Travel, Room and Board: Coordinate any out-of-state training with the University Project Manager.

E. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

3.3 DEMONSTRATION SCHEDULE

SECTION	TITLE	DESCRIPTION
10 11 00	VISUAL DISPLAY SURFACES	Engage a factory-authorized service representative to train University's maintenance personnel to adjust, operate, and maintain motor-operated, sliding visual display units.
23 00 00	HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)	Schedule instructional meetings for The University of Colorado Anschutz Medical Campus Facilities Operations maintenance personnel on the proper operation and maintenance of mechanical systems. Provide the project manager a minimum of 5 days notice prior to any testing.
23 08 00	COMMISIONING OF HVAC	Engage the commissioning authority to provide a customized one to two day training class for the university's engineering personnel in problem solving techniques including the review of mechanical system design as a whole, integrated unit, unique qualities of the installed mechanical system, insights into how to solve system-wide, multi-faceted problems, and identify a variety of resources to assist with problem solving.
23 09 00	INSTRUMENTATION AND CONTROLS	Engage a factory-authorized trained representative to conduct a minimum of 1-four hour on-site training course and an additional 1-four hour on-site training course per 25,000 sq. ft. for designated University personnel.
		Engage a factory-authorized trained representative to conduct an 8-hour seasonal loop training.
		Provide 40 hours of certified training in Instrument and Controls for every 100,000 sq. ft. of a lab/research building.
26 00 00	ELECTRICAL	Engage a factory-authorized service representative to train the University's Operations personnel a minimum of 8 hours for each system. Provide an additional minimum of 4 hours for any electrical gateway or networked lighting controls.
28 31 00	FIRE DETECTION AND ALARM	Engage a factory-authorized service representative to train the University's Operations personnel a minimum of 8 hours for each system.

END OF SECTION 01 79 00

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SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Related Requirements:
 - 1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.

1.3 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.
- B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.
 - 1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.
 - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
 - 4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
 - 5. Review areas where existing construction is to remain and requires protection.

1.5 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

- C. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 - 1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- D. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.
 - 1. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.
 - 1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

3.4 SELECTIVE DEMOLITION, GENERAL

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 3. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
 - 4. Maintain adequate ventilation when using cutting torches.
 - 5. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 - 6. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - 7. Dispose of demolished items and materials promptly.

3.5 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 024119

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SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Steel framing and supports for mechanical and electrical equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
- B. Related Requirements:
 - 1. Section 099123 "Interior Painting" for priming and painting requirements for interior metal fabrications.

1.3 COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Primer and paint products.
- B. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
 - 1. Steel framing and supports for mechanical and electrical equipment.
 - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 - 3. Metal.
- C. Delegated-Design Submittal: For ladders and equipment support systems using cold-formed adjustable metal framing and hot-rolled steel section supports (unistrut), including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 FIELD CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 FABRICATORS

- A. Fabricators: Subject to compliance with requirements, available fabricators offering services that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Meyers and Company, Basalt, CO, 970-927-4761.
 - 2. Western Slope Iron and Supply, Inc, Grand Junction, CO, 970-243-9770, www.wsiron.com.
 - 3. Zimkor LLC., Littleton, CO 303-791-1333.
 - 4. Zimmerman Metals Inc., Denver, CO, 303-294-0180.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design ladders and equipment support systems using cold-formed adjustable metal framing and hot-rolled steel section supports (unistrut).
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.3 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content: Provide materials/products that have post- and/or pre-consumer recycled content, by weight of total product.
- C. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Material: Galvanized steel, ASTM A 653/A 653M, commercial steel, Type B, with G90 coating; 0.108-inch nominal thickness.

2. Material: Cold-rolled steel, ASTM A 1008/A 1008M, commercial steel, Type B; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.

2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Steel Bolts and Nuts (Weathering): Regular hexagon-head bolts, ASTM A 325, Type 3; with hex nuts, ASTM A 563, Grade C3; and, where indicated, flat washers.
- D. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, ASTM F 593; with hex nuts, ASTM F 594; and, where indicated, flat washers; Alloy Group 1.
- E. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor straps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.5 MISCELLANEOUS MATERIALS

- A. Low-Emitting Paints and Coatings: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1113 OR California Air Resource Board (CARB) 2007-Suggested Control Measures (SCM) for Architectural Coatings, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- B. Shop Primers: Provide primers that comply with Section 099123 Interior Painting" for interior metal fabrications, and Section 099600 "High-Performance Coatings" for exterior metal fabrications.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Welding Rods and Bare Electrodes: Select according to AWS specification for metal alloy welded.

2.6 FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
 - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

D. Prime exposed miscellaneous framing and supports with primer specified in Section 099123 "Interior Painting" for interior locations and 099600 "High-Performance Coatings" for exterior locations.

2.8 FINISHES, GENERAL

- A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designing finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.9 STEEL AND IRON FINISHES

- A. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- B. Shop prime iron and steel items unless they are to be embedded in concrete, to receive sprayed-on fireproofing, installed against masonry, or unless otherwise indicated.
 - 1. Shop prime exposed interior metal fabrications with primers specified in Section 099123 "Interior Painting" unless otherwise noted.
 - 2. Shop prime exposed exterior metal fabrications with primers specified in Section 099600 "High Performance Coatings" unless otherwise noted.
 - 3. Shop prime metal fabrications with zinc-rich primer where indicated, and where metal fabrications are concealed behind framing that is outside the building air barrier.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Items Indicated to Receive Primers Specified in Section 099600 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 4. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
 - 1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 099123 "Interior Painting" and Section 099600 "High Performance Coatings."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Plastic-laminate-faced architectural cabinets.
- B. Related Requirements:
 - 1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.
 - 2. Section 123661.16 "Solid Surfacing Countertops."

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including high-pressure decorative laminate adhesive for bonding plastic laminate and cabinet hardware and accessories.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
 - 1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
 - 2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
- C. Samples for Initial Selection:
 - 1. Plastic laminates.
 - 2. PVC edge material.
- D. Samples for Verification:
 - 1. Plastic laminates, 8 by 10 inches, for each color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
 - 2. Exposed cabinet hardware and accessories, one unit for each type.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 - 1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.7 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Concepts in Millwork Inc., 1490 Tuskegee Place, Colorado Springs, CO 80915, 719-570-7353.
 - 2. E & J Cabinets, 6110 West 55th Avenue, Arvada, CO 80002, 303-4257527
 - 3. JK Concepts, Inc., 3333 East 52nd Avenue, Denver, CO 80216, 303-571-0672.
 - 4. MGC, Inc., 2061 Cheyenne Summer View, Colorado Springs, CO, 80904, 719-358-7436.
 - 5. Sidney Millwork Company, 1166 Cambrian Lane, Sidney, MT 59270, 406-482-2810.
 - 6. Unique Woodworking, 2605 West 7th Avenue, Denver, CO 80204, 303-573-3966.
 - 7. Wood Designs Limited, 2438 6th Avenue, Greeley, Colorado, 80631, 970-356-0339, www.wooddesignsltd.com.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: AWI Premium preferred; AWI Custom acceptable based on project cost.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Basis-of-Design: Subject to compliance with requirements provide products indicated on Drawings or approved substitution from the following:
 - a. Formica Corporation.
 - b. Panolam Industries International, Inc (Nevamar, Pionite).
 - c. Wilsonart International; Div. of Premark International, Inc.
- F. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Postformed Surfaces: Grade HGP.
 - 3. Vertical Surfaces: Grade HGS.
 - 4. Edges: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
- G. Materials for Semiexposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 0.12 inch thick, matching laminate in color, pattern, and finish.
 - b. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.
 - c. Balanced Construction: For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
- H. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- I. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated on Drawings.

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Low-Emitting Composite Wood: Provide materials/products that have low formaldehyde emissions that meet the California Air Resources Board (CARB) ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade 130.
 - 2. Particleboard: ANSI A208.1, Grade M-2.
 - 3. Particleboard: Straw-based particleboard complying with requirements in ANSI A208.1, Grade M-2, except for density.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Environ Biocomposites Manufacturing LLC; Biofiber Wheat.
 - 2) Sorm Incorporated; Primeboard Premium Wheat.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1.
 - 5. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for test methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 120 degrees of opening.
- C. Decorative Pulls:
 - 1. Basis-of-Design: Standard satin nickel D-Pull.
- D. Shelf Rests: BHMA A156.9, B04013; plastic, two-pin type with shelf hold-down clip.
- E. Catches: Magnatic catches, BHMA A156.9, B03141.
 - 1. Basis-of-Design: Subject to compliance with requirements, provide National C8103, or comparable product.

- F. Door Locks: Cylindrical (cam) type, five-pin tumbler, brass with chrome-plated finish, and complying with BHMA A156.11, Grade 1.
 - 1. Provide a minimum of two keys per lock and two master keys.
 - 2. Provide locks where indicated on Drawings.
- G. Door and Drawer Silencers: BHMA A156.16, L03011.
- H. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin chromium plated: BHMA 626 (US26D).
- I. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.5 MISCELLANEOUS MATERIALS

- A. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- B. Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- C. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.6 FABRICATION

- A. Fabricate cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.

C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- F. Cabinets: Install without distortion so doors fit openings properly and are accurately aligned. Adjust hardware to center doors in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
 - 1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
 - 2. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips, or No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

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SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Penetrations in fire-resistance-rated walls.
 - 2. Penetrations in horizontal assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Schedule: For each penetration firestopping system. Include location and design designation of qualified testing and inspecting agency.

1.4 INFORMATIONAL SUBMITTALS

A. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with its "Qualified Firestop Contractor Program Requirements."
- B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
 - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- C. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grace Construction Products.
 - 2. Hilti, Inc.
 - 3. Johns Manville.
 - 4. 3M Fire Protection Products.
 - 5. Tremco, Inc.; Tremco Fire Protection Systems Group.
 - 6. USG Corporation.

2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Fire-resistance-rated walls include wall assemblies as indicated on Drawings.
 - 2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Horizontal assemblies include floor, floor/ceiling assemblies as indicated on Drawings.
 - 2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
 - 3. T-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
- D. Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- E. 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.
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-wool-fiber or rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 MIXING

A. For those products requiring mixing before application, comply with penetration firestopping manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing penetration firestopping to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of penetration firestopping.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent penetration firestopping from contacting adjoining surfaces that will remain exposed on completion of the Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove stains. Remove tape as soon as possible without disturbing firestopping's seal with substrates.

3.3 INSTALLATION

- A. General: Install penetration firestopping to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestopping.
- C. Install fill materials for firestopping by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

- 1. The words "Warning Penetration Firestopping Do Not Disturb. Notify Building Management of Any Damage."
- 2. Contractor's name, address, and phone number.
- 3. Designation of applicable testing and inspecting agency.
- 4. Date of installation.
- 5. Manufacturer's name.
- 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage a qualified testing agency to perform tests and inspections.
- B. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
- C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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SECTION 079200 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Nonstaining silicone joint sealants.
 - 2. Urethane joint sealants.
 - 3. Immersible joint sealants.
 - 4. Mildew-resistant joint sealants.
 - 5. Butyl joint sealants.
 - 6. Latex joint sealants.
- B. Related Requirements:
 - 1. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each joint-sealant product.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant designation.
 - a. Use same designation as indicated in the Schedule at the end of this Section.
 - 2. Joint-sealant application and joint location.
 - 3. Joint-sealant manufacturer and product name.
 - 4. Joint-sealant formulation.
 - 5. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of joint sealant, for tests performed by a qualified testing agency.
- B. Field-Adhesion-Test Reports: For each sealant application tested.
- C. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

- A. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:
 - 1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
 - 2. Conduct field tests for each kind of sealant and joint substrate.
 - 3. Notify Architect seven days in advance of dates and times when test joints will be erected.
 - 4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
 - a. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 5. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
 - 6. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

- 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
- 2. When joint substrates are wet.
- 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
- 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.
- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.
- C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:
 - 1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
 - 2. Disintegration of joint substrates from causes exceeding design specifications.
 - 3. Mechanical damage caused by individuals, tools, or other outside agents.
 - 4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 JOINT SEALANTS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested according to ASTM C 1248.

- B. Silicone, Nonstaining, S, NS, 100/50, NT: Nonstaining, single-component, nonsag, plus 100 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 100/50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide the following:
 - a. Pecora Corporation; 890 FTS.

2.3 URETHANE JOINT SEALANTS

- A. Urethane, M, NS, 50, NT: Multicomponent, nonsag, plus 50 percent and minus 50 percent movement capability nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynatrol II.
- B. Urethane, M, P, 25, T, NT: Multicomponent, pourable, plus 25 percent and minus 25 percent movement capability, traffic- and nontraffic-use, urethane joint sealant; ASTM C 920, Type M, Grade P, Class 25, Uses T and NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Pecora Corporation; Dynatrol II SG.

2.4 MILDEW-RESISTANT JOINT SEALANTS

- A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.
- B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C 920, Type S, Grade NS, Class 25, Use NT.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 786-M White.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
 - c. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
 - d. Soudal USA; RTV GP.
 - e. Tremco Incorporated; Tremsil 200.

2.5 BUTYL JOINT SEALANTS

- A. Butyl-Rubber-Based Joint Sealants: ASTM C 1311.
 - 1. Products: Subject to compliance with requirements, provide one of the following:

- a. Bostik, Inc.; Chem-Calk 300.
- b. Pecora Corporation; BC-158.

2.6 LATEX JOINT SEALANTS

- A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. BASF Construction Chemicals Building Systems; Sonolac.
 - b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; .
 - c. Pecora Corporation; AC-20.
 - d. Sherwin-Williams Company (The); .
 - e. Tremco Incorporated; Tremflex 834.

2.7 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Construction Chemicals Building Systems.
 - b. Construction Foam Products, a division of Nomaco, Inc.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type B (bicellular material with a surface skin) except as noted, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance, typically 1.5 times the joint size.
 - 1. Basis-of-Design: Subject to compliance with requirements, provide the following, or comparable product:
 - a. SOF-Rod Bi-Cellular Polyethylene Backer Rod.
 - 2. At dual-line installations, provide Type O open-cell material at the in-board (primary) seal, to allow sealant out-gassing to pass through the backer rod.
- C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.8 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- Low-Emitting Paints and Coatings: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1113 OR California Air Resource Board (CARB) 2007-Suggested Control Measures (SCM) for Architectural Coatings, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
 - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 - 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
 - a. Concrete.
 - b. Masonry.
 - c. Unglazed surfaces of ceramic tile.
 - d. Exterior insulation and finish systems.
 - 3. Remove laitance and form-release agents from concrete.
 - 4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
 - a. Metal.

- b. Glass.
- c. Porcelain enamel.
- d. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.
- D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealant from surfaces adjacent to joints.
 - 2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 - 3. Provide concave joint profile per Figure 8A in ASTM C 1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

- A. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:
 - 1. Extent of Testing: Test completed and cured sealant joints as follows:
 - a. Perform 5 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.
 - b. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.
 - 2. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C 1193 or Method A, Tail Procedure, in ASTM C 1521.
 - a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
 - 3. Inspect tested joints and report on the following:
 - a. Whether sealants filled joint cavities and are free of voids.
 - b. Whether sealant dimensions and configurations comply with specified requirements.
 - c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.
 - 4. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.
 - 5. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.
- B. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

- A. Joint-Sealant JS-4:
 - 1. Application: Interior joints in horizontal traffic surfaces.
 - 2. Locations:
 - a. Isolation joints in exposed cast-in-place concrete slabs.
 - b. Control and expansion joints in stone flooring.
 - c. Control and expansion joints in brick flooring.
 - d. Control and expansion joints in tile flooring.
 - e. Other joints as indicated on Drawings.
 - 3. Formulation: Urethane, M, P, 25, T, NT.
 - 4. Color: As selected by Architect from manufacturer's full range of colors.
- B. Joint-Sealant JS-5:
 - 1. Application: Interior joints in vertical surfaces and horizontal non-traffic surfaces.
 - 2. Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Tile control and expansion joints.
 - c. Vertical joints on exposed surfaces of unit masonry, concrete walls and partitions.
 - d. Joints on underside of plant-precast structural concrete beams and planks.
 - e. Other joints as indicated on Drawings.
 - 3. Formulation: Urethane, M, NS, 50, NT.
 - 4. Color: As selected by Architect from manufacturer's full range of colors.
- C. Joint-Sealant JS-6:
 - 1. Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.
 - 2. Locations:
 - a. Perimeter joints between interior wall surfaces and frames of interior doors, windows and elevator entrances.
 - b. Other joints as indicated on Drawings.
 - 3. Formulation: Acrylic latex.
 - 4. Color:As selected by Architect from manufacturer's full range of colors.

- D. Joint-Sealant JS-7:
 - 1. Application: Mildew-resistant interior joints in vertical surfaces and horizontal non-traffic surfaces.
 - 2. Locations:
 - a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated on Drawings.
 - 3. Formulation: Silicone, mildew resistant, acid curing, S, NS, 25, NT .
 - 4. Color: As selected by Architect from manufacturer's full range of colors.
- E. Joint-Sealant JS-8:
 - 1. Application: Concealed mastics.
 - 2. Locations:
 - a. Aluminum thresholds.
 - b. Sill plates.
 - c. Other joints as indicated on Drawings.
 - 3. Formulation: Butyl-rubber based.
 - 4. Color: Manufacturer's standard color.

END OF SECTION

SECTION 079219 - ACOUSTICAL JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Acoustical joint sealants.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for elastomeric, latex, and butyl-rubber-based joint sealants for nonacoustical applications.

1.3 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.5 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

- B. Special Manufacturer's Warranty: Manufacturer agrees to furnish acoustical joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E 90.
- B. Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C 834.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 826 Acoustical Sound Sealant.
 - b. GE Construction Sealants; RCS20 Acoustical.
 - c. Grabber Construction Products; Acoustical Sealant GSC.
 - d. Henkel Corporation; OSI Pro-Series SC-175 Acoustical Sound Sealant.
 - e. Pecora Corporation; AC-20 FTR.
 - f. Serious Energy Inc.; Quiet Seal Pro.
 - g. Tremco, Incorporated; Tremco Acoustical Sealant.
 - h. USG Corporation; SHEETROCK Acoustical Sealant.
 - 2. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
 - Low-Emitting Paints and Coatings: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1113 OR California Air Resource Board (CARB) 2007-Suggested Control Measures (SCM) for Architectural Coatings, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C 919, ASTM C 1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. Acoustical Ceiling Areas: Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes hollow-metal work.
- B. Related Requirements:
 - 1. Section 081416 "Flush Wood Doors" for solid core wood doors installed in hollow-metal frames.
 - 2. Section 087100 "Door Hardware" for door hardware for hollow-metal doors.
 - 3. Section 099123 "Interior Painting" for field painting of interior hollow-metal doors and frames.

1.3 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.

1.4 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings: Include the following:
 - 1. Elevations of each door type.
 - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
 - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 - 4. Locations of reinforcement and preparations for hardware, including high-frequency hinge preparations.
 - 5. Details of each different wall opening condition.
 - 6. Details of anchorages, joints, field splices, and connections.

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- 7. Details of accessories.
- 8. Details of moldings, removable stops, and glazing.
- 9. Details of conduit and preparations for power, signal, and control systems.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- 1.6 INFORMATIONAL SUBMITTALS
 - A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
 - B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
 - C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ceco Door; ASSA ABLOY.
 - 2. Curries Company; ASSA ABLOY.
 - 3. Mesker Door Inc.
 - 4. Republic Doors and Frames.
 - 5. Rocky Mountain Metals, Inc.
 - 6. Southwestern Hollow Metal Co.
 - 7. Steelcraft; an Ingersoll-Rand company.
 - 8. West Central Mfg. Inc.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.2 REGULATORY REQUIREMENTS

- A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
 - 1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.
- B. Fire-Rated, Borrowed-Lite Assemblies: Complying with NFPA 80 and 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 or UL 9.

2.3 INTERIOR DOORS AND FRAMES

- A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Heavy-Duty Doors and Frames: SDI A250.8, Level 2.
 - 1. Physical Performance: Level B according to SDI A250.4.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.054 inch (17 gauge).
 - b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
 - c. Construction: Full profile welded.
 - 3. Exposed Finish: Prime.

2.4 BORROWED LITES

- A. Hollow-metal frames of uncoated steel sheet, minimum thickness of 0.054 inch.
- B. Construction: Full profile welded.
- 2.5 FRAME ANCHORS
 - A. Jamb Anchors:
 - 1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.
 - B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch, and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2.6 MATERIALS

- A. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- B. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- E. Glazing: Comply with requirements in Section 088000 "Glazing."

2.7 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 - 1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
 - 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 - 3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
 - 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. 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 one additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.

- 5. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
- 6. Electrical Thru-Wiring: Provide hollow metal frames receiving electrified hardware with loose wiring harness (not attached to open throat components or installed in closed mullion tubes) and standardized Molex plug connectors on one end to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electric through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware and "Access Control Hardware."
- 7. Electrical Knock- Out Boxes: Factory weld 18 gauge electrical knock-out boxes to frame for electrical hardware preps including but not limited to; electric through-wire transfer hardware, electrical raceways and wiring harnesses, door position switches, electric strikes, magnetic locks, and jamb mounted card readers as specified in hardware sets in Division 08 Sections "Door Hatdware" and "Access Control Hardware."
 - a. Provide electrical knock-out boxes with dual 1/2 inch and 3/4 inch knockouts.
 - b. Conduit to be coordinated and installed in the field (Division26) from middle hinge box and strike box to door position box.
 - c. Electrical knock-out boxes to comply with NFPA requirements and fit electrical door hardware as specified in hardware sets in Division 08 Section "Door Hardware."
 - d. Electrical knock-out boxes for continuous hinges should be located in the center of the vertical dimension of the hinge jamb.
- C. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- D. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
 - 1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
 - 2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- E. High Frequency Hinge Preparations for Frames:
 - 1. Provide auxiliary welded reinforcement at the top hinge of door frame to prevent potential door sag, as described in SDI-111-09.
 - 2. Locations: Provide at all main entrance doors, rear exit doors, auditoriums, cafeterias, and gymnasiums.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with mitered hairline joints.
 - 1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.
 - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
 - 3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.
 - 4. Provide loose stops and moldings on inside of hollow-metal work.
 - 5. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.8 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
 - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
 - Low-Emitting Paints and Coatings: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1113 OR California Air Resource Board (CARB) 2007-Suggested Control Measures (SCM) for Architectural Coatings, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames for doors, transoms, sidelites, borrowed lites, and other openings, of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

- 1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-rated openings, install frames according to NFPA 80.
 - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
 - c. Install frames with removable stops located on secure side of opening.
 - d. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - e. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
- 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
- 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
- 4. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Steel Doors:
 - a. Between Door and Frame Jambs and Head: 1/8 inch plus or minus 1/32 inch.
 - b. Between Edges of Pairs of Doors: 1/8 inch to 1/4 inch plus or minus 1/32 inch.
 - c. At Bottom of Door: 5/8 inch plus or minus 1/32 inch.
 - d. Between Door Face and Stop: 1/16 inch to 1/8 inch plus or minus 1/32 inch.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
 - 3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.
- D. Glazing: Comply with installation requirements in Section 088000 "Glazing" and with hollow-metal manufacturer's written instructions.
 - 1. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid-core doors with wood-veneer faces for transparent finish.
 - 2. Factory finishing flush wood doors.
 - 3. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 088813 "Fire-Resistant Glazing" for fire-rated glass panels in flush wood doors.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, louvers, and trim for openings. Include factory-finishing specifications.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:
 - 1. Dimensions and locations of blocking.
 - 2. Dimensions and locations of mortises and holes for hardware.
 - 3. Dimensions and locations of cutouts.
 - 4. Undercuts.
 - 5. Requirements for veneer matching.
 - 6. Doors to be factory finished and finish requirements.
 - 7. Fire-protection ratings for fire-rated doors.
- C. Samples for Initial Selection: For factory-finished doors.
- D. Samples for Verification:
 - 1. Corner sections of doors, approximately 8 by 10 inches (200 by 250 mm), with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door onbottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ASSA ABLOY Wood Doors (GR): GPD Series.

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- 2. Eggers Industries.
- 3. Marshfield-Algoma (MF): Signature Series.
- 4. VT Industries, Inc.(VT): Artistry Series.
- B. Source Limitations: Obtain flush wood doorsfrom single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
- B. WDMA I.S.1-A Performance Grade:
 - 1. Heavy Duty unless otherwise indicated.
- C. Fire-Rated Wood Doors: Doors 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 NFPA 252 or UL 10C.
- D. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
- E. Particleboard-Core Doors:
 - 1. Low-Emitting Composite Wood: Provide materials/products that have low formaldehyde emissions that meet the California Air Resources Board (CARB) ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
 - 2. Particleboard: ANSI A208.1, Grade LD-2.
 - Particleboard: Straw-based particleboard complying with ANSI A208.1, Grade LD-2 or M-2, except for density.
 - 4. Blocking: Provide wood blocking in particleboard-core doors as follows:
 - a. 5-inch top-rail blocking, in doors indicated to have closers.
 - b. 5-inch bottom-rail blocking, in exterior doors and doors indicated to have kick, mop, or armor plates.
 - 5. Provide doors with structural-composite-lumber cores instead of particleboard cores for doors indicated to receive exit devices.
- F. Structural-Composite-Lumber-Core Doors:
 - 1. Structural Composite Lumber: WDMA I.S.10.
 - a. Screw Withdrawal, Face: 700 lbf.
 - b. Screw Withdrawal, Edge: 400 lbf.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

- A. Interior Solid-Core Doors :
 - 1. Grade: Premium, with Grade A faces.
 - 2. Species: Match existing doors.

- 3. Cut: Plain sliced (flat sliced).
- 4. Match between Veneer Leaves: Book match.
- 5. Assembly of Veneer Leaves on Door Faces: Running match.
- 6. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
- 7. Exposed Verticaland Top Edges: Same species as faces or a compatible species edge Type A.
- 8. Core: Particleboard, except use structural composite lumber for half-lite and full-lite doors.
- 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering. Faces are bonded to core using a hot press.

2.4 LIGHT FRAMES AND LOUVERS

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 - 1. Wood Species: Same species as door faces.
 - 2. Profile: M1 Flush Bead.
- B. Metal Frames for Light Openings in Fire-Rated Doors: Manufacturer's standard frame formed of 0.048-inch- thick, cold-rolled steel sheet; factory primed for paint finish; and approved for use in doors of fire-protection rating indicated.
- 2.5 ELECTRICAL RACEWAYS: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex plug connectors on both ends to accommodate up to twelve (12) wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in Section 087100 "Door Hardware." Wire nut connections are not acceptable.

2.6 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
- C. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing."

2.7 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted onbottom edges, edges of cutouts, and mortises.
- B. Factory finish doors that are indicated to receive transparent finish.
- C. Transparent Finish:
 - Low-Emitting Paints and Coatings: Provide products that comply with South Coast Air Quality Management District (SCAQMD) Rule 1113 OR California Air Resource Board (CARB) 2007-Suggested Control Measures (SCM) for Architectural Coatings, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
 - 2. Grade: Custom.
 - 3. Finish: WDMA TR-8/AWS System 9, UV Cured Acrylated Polyurethane.
 - 4. Staining: Match existing wood stain.
 - 5. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 - 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 - 1. Install fire-rated doors according to NFPA 80.
 - 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes access doors and frames for walls and ceilings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Karp Associates, Inc.
 - d. Lane-Aire Manufacturing Corp.
 - e. Larsens Manufacturing Company.
 - f. Maxam Metal Products Limited.
 - g. MIFAB, Inc.
 - 2. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: Minimum size required for equipment access.
 - 5. Uncoated Steel Sheet for Door: Nominal 0.060 inch , 16 gage, factory primed.

- 6. Frame Material: Same material, thickness, and finish as door.
- 7. Latch and Lock: Cam latch, key operated.

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Exposed Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acudor Products, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Karp Associates, Inc.
 - d. Lane-Aire Manufacturing Corp.
 - e. Larsens Manufacturing Company.
 - f. Maxam Metal Products Limited.
 - g. MIFAB, Inc.
 - 2. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
 - 3. Locations: Wall and ceiling.
 - 4. Door Size: Minimum size required to access equipment.
 - 5. Fire-Resistance Rating: Not less than that of adjacent construction.
 - 6. Uncoated Steel Sheet for Door: Nominal 0.036 inch , 20 gage, factory primed.
 - 7. Frame Material: Same material, thickness, and finish as door.
 - 8. Latch and Lock: Self-latching door hardware, operated by key.

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.

- 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
- 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 ADJUSTING

A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 083113

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SECTION 087100 – DOOR HARDWARE

PART 1 - GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Mechanical and electrified door hardware
 - 2. Electronic access control system components
 - 3. Field verification, preparation and modification of existing doors and frames to receive new door hardware.
- B. Section excludes:
 - 1. Windows
 - 2. Cabinets (casework), including locks in cabinets
 - 3. Signage
- C. Related Sections:
 - 1. Division 01 Section "Alternates" for alternates affecting this section.
 - 2. Division 06 Section "Rough Carpentry"
 - 3. Division 06 Section "Finish Carpentry"
 - 4. Division 07 Section "Joint Sealants" for sealant requirements applicable to threshold installation specified in this section.
 - 5. Division 08 Sections:
 - a. "Metal Doors and Frames"
 - b. "Flush Wood Doors"
 - 6. Division 09 sections for touchup, finishing or refinishing of existing openings modified by this section.
 - 7. Division 26 "Electrical" sections for connections to electrical power system and for low-voltage wiring.
 - 8. Division 28 "Electronic Safety and Security" sections for coordination with other components of electronic access control system and fire alarm system.

1.02 REFERENCES

- A. UL, LLC
 - 1. UL 10B Fire Test of Door Assemblies
 - 2. UL 10C Positive Pressure Test of Fire Door Assemblies
 - 3. UL 1784 Air Leakage Tests of Door Assemblies
 - 4. UL 305 Panic Hardware
- B. DHI Door and Hardware Institute
 - 1. Sequence and Format for the Hardware Schedule
 - 2. Recommended Locations for Builders Hardware
 - 3. Keying Systems and Nomenclature
 - 4. Installation Guide for Doors and Hardware
- C. NFPA National Fire Protection Association
 - 1. NFPA 70 National Electric Code
 - 2. NFPA 80 2016 Edition Standard for Fire Doors and Other Opening Protectives

University of Colorado - Denver Anschutz Medical Campus Fitz Bldg Grnd NG015, NG016 Reno

- 3. NFPA 101 Life Safety Code
- 4. NFPA 105 Smoke and Draft Control Door Assemblies
- 5. NFPA 252 Fire Tests of Door Assemblies
- D. ANSI American National Standards Institute
 - 1. ANSI A117.1 2017 Edition Accessible and Usable Buildings and Facilities
 - 2. ANSI/BHMA A156.1 A156.29, and ANSI/BHMA A156.31 Standards for Hardware and Specialties
 - 3. ANSI/BHMA A156.28 Recommended Practices for Keying Systems
 - 4. ANSI/WDMA I.S. 1A Interior Architectural Wood Flush Doors
 - 5. ANSI/SDI A250.8 Standard Steel Doors and Frames

1.03 SUBMITTALS

- A. General:
 - 1. Submit in accordance with Conditions of Contract and Division 01 Submittal Procedures.
 - 2. Prior to forwarding submittal:
 - a. Comply with procedures for verifying existing door and frame compatibility for new hardware, as specified in PART 3, "EXAMINATION" article, herein.
 - b. Review drawings and Sections from related trades to verify compatibility with specified hardware.
 - c. Highlight, encircle, or otherwise specifically identify on submittals: deviations from Contract Documents, issues of incompatibility or other issues which may detrimentally affect the Work.
- B. Action Submittals:
 - 1. Product Data: Submit technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finish, and other information necessary to show compliance with requirements.
 - 2. Riser and Wiring Diagrams: After final approval of hardware schedule, submit details of electrified door hardware, indicating:
 - a. Wiring Diagrams: For power, signal, and control wiring and including:
 - 1) Details of interface of electrified door hardware and building safety and security systems.
 - 2) Schematic diagram of systems that interface with electrified door hardware.
 - 3) Point-to-point wiring.
 - 4) Risers.
 - 3. Samples for Verification: If requested by Architect, submit production sample of requested door hardware unit in finish indicated and tagged with full description for coordination with schedule.
 - a. Samples will be returned to supplier. Units that are acceptable to Architect may, after final check of operations, be incorporated into Work, within limitations of key coordination requirements.
 - 4. Door Hardware Schedule:
 - a. Submit concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate fabrication of other work critical in Project construction schedule.
 - b. Submit under direct supervision of a Door Hardware Institute (DHI) certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) with

hardware sets in vertical format as illustrated by Sequence of Format for the Hardware Schedule published by DHI.

- c. Indicate complete designations of each item required for each opening, include:
 - 1) Door Index: door number, heading number, and Architect's hardware set number.
 - 2) Quantity, type, style, function, size, and finish of each hardware item.
 - 3) Name and manufacturer of each item.
 - 4) Fastenings and other pertinent information.
 - 5) Location of each hardware set cross-referenced to indications on Drawings.
 - 6) Explanation of all abbreviations, symbols, and codes contained in schedule.
 - 7) Mounting locations for hardware.
 - 8) Door and frame sizes and materials.
 - 9) Degree of door swing and handing.
 - 10) Operational Description of openings with electrified hardware covering egress, ingress (access), and fire/smoke alarm connections.
- 5. Key Schedule:
 - a. After Keying Conference, provide keying schedule that includes levels of keying, explanations of key system's function, key symbols used, and door numbers controlled.
 - b. Use ANSI/BHMA A156.28 "Recommended Practices for Keying Systems" as guideline for nomenclature, definitions, and approach for selecting optimal keying system.
 - c. Provide 3 copies of keying schedule for review prepared and detailed in accordance with referenced DHI publication. Include schematic keying diagram and index each key to unique door designations.
 - d. Index keying schedule by door number, keyset, hardware heading number, cross keying instructions, and special key stamping instructions.
 - e. Provide one complete bitting list of key cuts and one key system schematic illustrating system usage and expansion. Forward bitting list, key cuts and key system schematic directly to Owner, by means as directed by Owner.
 - f. Prepare key schedule by or under supervision of supplier, detailing Owner's final keying instructions for locks.
- C. Informational Submittals:
 - 1. Provide Qualification Data for Supplier, Installer and Architectural Hardware Consultant.
 - 2. Provide Product Data:
 - a. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
 - b. Include warranties for specified door hardware.
- D. Closeout Submittals:
 - 1. Operations and Maintenance Data: Provide in accordance with Division 01 and include:
 - a. Complete information on care, maintenance, and adjustment; data on repair and replacement parts, and information on preservation of finishes.
 - b. Catalog pages for each product.
 - c. Final approved hardware schedule edited to reflect conditions as installed.
 - d. Final keying schedule
 - e. Copy of warranties including appropriate reference numbers for manufacturers to identify project.
 - f. As-installed wiring diagrams for each opening connected to power, both low voltage and 110 volts.
- E. Inspection and Testing:

- 1. Submit written reports to the Owner and Authority Having Jurisdiction (AHJ) of the results of functional testing and inspection for:
 - a. fire door assemblies, in compliance with NFPA 80.
 - b. required egress door assemblies, in compliance with NFPA 101.

1.04 QUALITY ASSURANCE

- A. Qualifications and Responsibilities:
 - 1. Supplier: Recognized architectural hardware supplier with a minimum of 5 years documented experience supplying both mechanical and electromechanical door hardware similar in quantity, type, and quality to that indicated for this Project. Supplier to be recognized as a factory direct distributor by the manufacturer of the primary materials with a warehousing facility in the Project's vicinity. Supplier to have on staff, a certified Architectural Hardware Consultant (AHC) or Door Hardware Consultant (DHC) available to Owner, Architect, and Contractor, at reasonable times during the Work for consultation.
 - 2. Installer: Qualified tradesperson skilled in the application of commercial grade hardware with experience installing door hardware similar in quantity, type, and quality as indicated for this Project.
 - 3. Architectural Hardware Consultant: Person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and meets these requirements:
 - a. For door hardware: DHI certified AHC or DHC.
 - b. Can provide installation and technical data to Architect and other related subcontractors.
 - c. Can inspect and verify components are in working order upon completion of installation.
 - d. Capable of producing wiring diagram and coordinating installation of electrified hardware with Architect and electrical engineers.
 - 4. Single Source Responsibility: Obtain each type of door hardware from single manufacturer.

B. Certifications:

- 1. Fire-Rated Door Openings:
 - a. Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction.
 - b. Provide only items of door hardware that are listed products tested by UL LLC, Intertek Testing Services, or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
- 2. Smoke and Draft Control Door Assemblies:
 - a. Provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105
 - b. Comply with the maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
- 3. Electrified Door Hardware
 - a. Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.

- 4. Accessibility Requirements:
 - a. Comply with governing accessibility regulations cited in "REFERENCES" article 087100, 1.02.D3 herein for door hardware on doors in an accessible route. This project must comply with all Federal Americans with Disability Act regulations and all Local Accessibility Regulations.
- C. Pre-Installation Meetings
 - 1. Keying Conference
 - a. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including:
 - 1) Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 - 2) Preliminary key system schematic diagram.
 - 3) Requirements for key control system.
 - 4) Requirements for access control.
 - 5) Address for delivery of keys.
 - 2. Pre-installation Conference
 - a. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - b. Inspect and discuss preparatory work performed by other trades.
 - c. Inspect and discuss electrical roughing-in for electrified door hardware.
 - d. Review sequence of operation for each type of electrified door hardware.
 - e. Review required testing, inspecting, and certifying procedures.
 - f. Review questions or concerns related to proper installation and adjustment of door hardware.
 - 3. Electrified Hardware Coordination Conference:
 - a. Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for hardware delivered to Project site. Promptly replace products damaged during shipping.
- B. Tag each item or package separately with identification coordinated with final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package. Deliver each article of hardware in manufacturer's original packaging.
- C. Maintain manufacturer-recommended environmental conditions throughout storage and installation periods.
- D. Provide secure lock-up for door hardware delivered to Project. Control handling and installation of hardware items so that completion of Work will not be delayed by hardware losses both before and after installation.
- E. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work. Protect products against malfunction due to paint, solvent, cleanser, or any chemical agent.

F. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

1.06 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory or shop prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where existing doors, frames and/or hardware are to remain, field verify existing functions, conditions and preparations and coordinate to suit opening conditions and to provide proper door operation.

1.07 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within published warranty period.
 - 1. Warranty does not cover damage or faulty operation due to improper installation, improper use or abuse.
 - 2. Warranty Period: Beginning from date of Substantial Completion, for durations indicated in manufacturer's published listings.
 - a. Mechanical Warranty
 - 1) Locks
 - a) Schlage L Series: 3 years
 - b) Schlage ND Series: 10 years
 - c) Best 9k : 10 years
 - 2) Closers
 - a) LCN 4000 Series: 30 years

1.08 MAINTENANCE

- A. Furnish complete set of special tools required for maintenance and adjustment of hardware, including changing of cylinders.
- B. Turn over unused materials to Owner for maintenance purposes.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. The Owner requires use of certain products for their unique characteristics and project suitability to ensure continuity of existing and future performance and maintenance standards.

After investigating available product offerings, the Awarding Authority has elected to prepare proprietary specifications. These products are specified with the notation: "No Substitute."

- 1. Where "No Substitute" is noted, submittals and substitution requests for other products will not be considered.
- B. Approval of alternate manufacturers and/or products other than those listed as "Scheduled Manufacturer" or "Acceptable Manufacturers" in the individual article for the product category are only to be considered by official substitution request in accordance in section 01 25 00.
- C. Approval of products from manufacturers indicated in "Acceptable Manufacturers" is contingent upon those products providing all functions and features and meeting all requirements of scheduled manufacturer's product.
- D. Where specified hardware is not adaptable to finished shape or size of members requiring hardware, furnish suitable types having same operation and quality as type specified, subject to Architect's approval.

2.02 MATERIALS

- A. Fabrication
 - 1. Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. provide screws according to manufacturer's recognized installation standards for application intended.
 - 2. Finish exposed screws to match hardware finish, or, if exposed in surfaces of other work, to match finish of this other work including prepared for paint surfaces to receive painted finish.
 - 3. Provide concealed fasteners wherever possible for hardware units exposed when door is closed. Coordinate with "Metal Doors and Frames", "Flush Wood Doors", "Stile and Rail Wood Doors" to ensure proper reinforcements. Advise the Architect where visible fasteners, such as thru bolts, are required.
- B. Provide screws, bolts, expansion shields, drop plates and other devices necessary for hardware installation.
 - 1. Where fasteners are exposed to view: Finish to match adjacent door hardware material.

2.03 HINGES

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Ives 5BB series
 - 2. Acceptable Manufacturers and Products:
 - a. Hager BB1191/1279 series
 - b. McKinney TB series
 - c. Best FBB series
- B. Requirements:
 - 1. Provide hinges conforming to ANSI/BHMA A156.1.
 - 2. Provide five knuckle, ball bearing hinges.
 - 3. 1-3/4 inch (44 mm) thick doors, up to and including 36 inches (914 mm) wide:
 - a. Exterior: Standard weight, bronze or stainless steel, 4-1/2 inches (114 mm) high

- b. Interior: Standard weight, steel, 4-1/2 inches (114 mm) high
- 4. 1-3/4 inch (44 mm) thick doors over 36 inches (914 mm) wide:
 - a. Exterior: Heavy weight, bronze/stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 5. 2 inches or thicker doors:
 - a. Exterior: Heavy weight, bronze or stainless steel, 5 inches (127 mm) high
 - b. Interior: Heavy weight, steel, 5 inches (127 mm) high
- 6. Adjust hinge width for door, frame, and wall conditions to allow proper degree of opening.
- 7. Provide three hinges per door leaf for doors 90 inches (2286 mm) or less in height, and one additional hinge for each 30 inches (762 mm) of additional door height.
- 8. Where new hinges are specified for existing doors or existing frames, provide new hinges of identical size to hinge preparation present in existing door or existing frame.
- 9. Hinge Pins: Except as otherwise indicated, provide hinge pins as follows:
 - a. Steel Hinges: Steel pins
 - b. Non-Ferrous Hinges: Stainless steel pins
 - c. Out-Swinging Exterior Doors: Non-removable pins
 - d. Out-Swinging Interior Lockable Doors: Non-removable pins
 - e. Interior Non-lockable Doors: Non-rising pins
- 10. Provide hinges with electrified options as scheduled in the hardware sets. Provide with number and gage of wires enough to accommodate electric function of specified hardware. Locate electric hinge at second hinge from bottom or nearest to electrified locking component. Provide mortar guard for each electrified hinge specified.

2.04 MORTISE LOCKS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage L9000 series
 - 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 - 1. Provide mortise locks conforming to ANSI/BHMA A156.13 Series 1000, Grade 1, and UL Listed for 3-hour fire doors.
 - 2. Indicators: Where specified, provide indicator window measuring a minimum 2-inch x 1/2 inch with 180-degree visibility. Provide messages color-coded with full text and/or symbols, as scheduled, for easy visibility.
 - 3. Provide locks manufactured from heavy gauge steel, containing components of steel with a zinc dichromate plating for corrosion resistance.
 - 4. Provide lock case that is multi-function and field reversible for handing without opening case. Cylinders: Refer to "KEYING" article, herein.
 - 5. Provide locks with standard 2-3/4 inches (70 mm) backset with full 3/4 inch (19 mm) throw stainless steel mechanical anti-friction latchbolt. Provide deadbolt with full 1-inch (25 mm) throw, constructed of stainless steel.
 - 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 - 7. Provide electrified options as scheduled in the hardware sets. Where scheduled, provide switches and sensors integrated into the locks and latches. Provide motor based electrified locksets that comply with the following requirements:

- a. Universal input voltage single chassis accepts 12 or 24VDC to allow for changes in the field without changing lock chassis.
- b. Fail Safe/Fail Secure changing mode between electrically locked (fail safe) and electrically unlocked (fail secure) is field selectable without opening the lock case
- c. Low maximum current draw maximum 0.4 amps to allow for multiple locks on a single power supply.
- d. Low holding current maximum 0.01 amps to produce minimal heat, eliminate "hot levers" in electrically locked applications, and to provide reliable operation in wood doors that provide minimal ventilation and air flow.
- e. Connections provide quick-connect Molex system standard.
- 8. Lever Trim: Solid brass, bronze, or stainless steel, cast or forged in design specified, with wrought roses and external lever spring cages. Provide thru-bolted levers with 2-piece spindles.
 - a. Provide levers with vandal resistant technology for use at heavy traffic or abusive applications.
 - b. Lever Design: Sparta / match existing

2.05 CYLINDRICAL LOCKS – GRADE 1

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. Schlage ND series
 - b. Best 9K
 - 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 - 1. Provide cylindrical locks conforming to ANSI/BHMA A156.2 Series 4000, Grade 1, and UL Listed for 3-hour fire doors.
 - 2. Cylinders: Refer to "KEYING" article, herein.
 - 3. Provide locks with standard 2-3/4 inches (70 mm) backset, unless noted otherwise, with 1/2-inch latch throw. Provide proper latch throw for UL listing at pairs.
 - 4. Provide locksets with separate anti-rotation thru-bolts, and no exposed screws.
 - 5. Provide independently operating levers with two external return spring cassettes mounted under roses to prevent lever sag.
 - 6. Provide standard ASA strikes unless extended lip strikes are necessary to protect trim.
 - 7. Provide electrified options as scheduled in the hardware sets.
 - 8. Lever Trim: Solid cast levers without plastic inserts and wrought roses on both sides.
 - a. Lever Design:Sparta / match existing

2.06 CYLINDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer and Product:
 - a. Match existing SFIC Key System
 - 2. Acceptable Manufacturers and Products:
 - a. No Substitute

- B. Requirements:
 - 1. Provide interchangeable cylinders/cores to match Owner's existing key system, compliant with ANSI/BHMA A156.5; latest revision; cylinder face finished to match lockset, manufacturer's series as indicated. Refer to "KEYING" article, herein.

2.07 KEYING

- A. Scheduled System:
 - a. Provide cylinders/cores keyed into Owner's existing factory registered keying system. Comply with guidelines in ANSI/BHMA A156.28, incorporating decisions made at keying conference.

B. Requirements:

- 1. Permanent Keying:
 - a. Provide permanent cylinders/cores keyed by the manufacturer according to the following key system.
 - 1) Master Keying system as directed by the Owner.
 - b. Forward bitting list and keys separately from cylinders, by means as directed by Owner. Failure to comply with forwarding requirements will be cause for replacement of cylinders/cores involved at no additional cost to Owner.
 - c. Provide keys with the following features:
 - 1) Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
 - 2) Patent Protection: Keys and blanks protected by one or more utility patent(s).
 - d. Identification:
 - 1) Mark permanent cylinders/cores and keys with applicable blind code for identification. Do not provide blind code marks with actual key cuts.
 - 2) Identification stamping provisions must be approved by the Architect and Owner.
 - 3) Stamp cylinders/cores and keys with Owner's unique key system facility code as established by the manufacturer; key symbol and embossed or stamped with "DO NOT DUPLICATE" along with the "PATENTED" or patent number to enforce the patent protection.
 - 4) Failure to comply with stamping requirements will be cause for replacement of keys involved at no additional cost to Owner.
 - 5) Forward permanent cylinders/cores to Owner, separately from keys, by means as directed by Owner.
 - e. Quantity: Furnish in the following quantities.
 - 1) Change (Day) Keys: 3 per cylinder/core.
 - 2) Permanent Control Keys: 3.
 - 3) Master Keys: 6.

2.08 DOOR CLOSERS

- A. Manufacturers and Products:
 - 1. Scheduled Manufacturer and Product:
 - a. LCN 4040XP series

- 2. Acceptable Manufacturers and Products:
 - a. No Substitute
- B. Requirements:
 - 1. Provide door closers conforming to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory. ISO 9000 certify closers. Stamp units with date of manufacture code.
 - 2. Provide door closers with fully hydraulic, full rack and pinion action with high strength cast iron cylinder, and full complement bearings at shaft.
 - 3. Cylinder Body: 1-1/2-inch (38 mm) diameter piston with 5/8-inch (16 mm) diameter double heat-treated pinion journal. QR code with a direct link to maintenance instructions.
 - 4. Hydraulic Fluid: Fireproof, passing requirements of UL10C, and requiring no seasonal closer adjustment for temperatures ranging from 120 degrees F to -30 degrees F.
 - 5. Spring Power: Continuously adjustable over full range of closer sizes, and providing reduced opening force as required by accessibility codes and standards. Provide snap-on cover clip, with plastic covers, that secures cover to spring tube.
 - 6. Hydraulic Regulation: By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck. Provide graphically labelled instructions on the closer body adjacent to each adjustment valve. Provide positive stop on reg valve that prevents reg screw from being backed out.
 - 7. Provide closers with solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
 - 8. Pressure Relief Valve (PRV) Technology: Not permitted.
 - 9. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers: Powder coating finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B117, or has special rust inhibitor (SRI).
 - 10. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.

2.09 DOOR STOPS AND HOLDERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives
 - 2. Acceptable Manufacturers:
 - a. Trimco
 - b. Burns
 - c. Rockwood
- B. Provide door stops at each door leaf:
 - 1. Provide wall stops wherever possible. Provide concave type where lockset has a push button of thumbturn.
 - 2. Where a wall stop cannot be used, provide universal floor stops.
 - 3. Where wall or floor stop cannot be used, provide overhead stop.
 - 4. Provide roller bumper where doors open into each other and overhead stop cannot be used.

2.10 THRESHOLDS, SEALS, DOOR SWEEPS, AUTOMATIC DOOR BOTTOMS, AND GASKETING

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Zero International
 - 2. Acceptable Manufacturers:
 - a. National Guard
 - b. Reese
 - c. DHSI
 - d. Legacy
 - e. Pemko
- B. Requirements:
 - 1. Provide thresholds, weather-stripping, and gasketing systems as specified and per architectural details. Match finish of other items.
 - 2. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 3. Provide door sweeps, seals, astragals, and auto door bottoms only of type where resilient or flexible seal strip is easily replaceable and readily available.
 - 4. Size thresholds 1/2 inch (13 mm) high by 5 inches (127 mm) wide by door width unless otherwise specified in the hardware sets or detailed in the drawings.

2.11 SILENCERS

- A. Manufacturers:
 - 1. Scheduled Manufacturer:
 - a. Ives
 - 2. Acceptable Manufacturers:
 - a. Burns
 - b. Rockwood
 - c. Trimco
- B. Requirements:
 - 1. Provide "push-in" type silencers for hollow metal or wood frames.
 - 2. Provide one silencer per 30 inches (762 mm) of height on each single frame, and two for each pair frame.
 - 3. Omit where gasketing is specified.

2.12 FINISHES

- A. Finish: BHMA 626/652 (US26D); except:
 - 1. Hinges at Exterior Doors: BHMA 630 (US32D)
 - 2. Aluminum Geared Continuous Hinges: BHMA 628 (US28)
 - 3. Push Plates, Pulls, and Push Bars: BHMA 630 (US32D)
 - 4. Protection Plates: BHMA 630 (US32D)
 - 5. Overhead Stops and Holders: BHMA 630 (US32D)
 - 6. Door Closers: Powder Coat to Match
 - 7. Wall Stops: BHMA 630 (US32D)

- 8. Latch Protectors: BHMA 630 (US32D)
- 9. Weatherstripping: Clear Anodized Aluminum
- 10. Thresholds: Mill Finish Aluminum

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance. Verify doors, frames, and walls have been properly reinforced for hardware installation.
- B. Field verify existing doors and frames receiving new hardware and existing conditions receiving new openings. Verify that new hardware is compatible with existing door and frame preparation and existing conditions.
- C. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- D. Submit a list of deficiencies in writing and proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Where on-site modification of doors and frames is required:
 - 1. Carefully remove existing door hardware and components being reused. Clean, protect, tag, and store in accordance with storage and handling requirements specified herein.
 - 2. Field modify and prepare existing doors and frames for new hardware being installed.
 - 3. When modifications are exposed to view, use concealed fasteners, when possible.
 - 4. Prepare hardware locations and reinstall in accordance with installation requirements for new door hardware and with:
 - a. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
 - b. Wood Doors: DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."
 - c. Doors in rated assemblies: NFPA 80 for restrictions on on-site door hardware preparation.

3.03 INSTALLATION

- A. Mount door hardware units at heights to comply with the following, unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Custom Steel Doors and Frames: HMMA 831.
 - 3. Interior Architectural Wood Flush Doors: ANSI/WDMA I.S. 1A
 - 4. Installation Guide for Doors and Hardware: DHI TDH-007-20
- B. Install door hardware in accordance with NFPA 80, NFPA 101 and provide post-install inspection, testing as specified in section 1.03.E unless otherwise required to comply with governing regulations.

- C. Install each hardware item in compliance with manufacturer's instructions and recommendations, using only fasteners provided by manufacturer.
- D. Do not install surface mounted items until finishes have been completed on substrate. Protect all installed hardware during painting.
- E. Set units level, plumb and true to line and location. Adjust and reinforce attachment substrate as necessary for proper installation and operation.
- F. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- G. Install operating parts so they move freely and smoothly without binding, sticking, or excessive clearance.
- H. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than quantity recommended by manufacturer for application indicated.
- I. Wiring: Coordinate with Division 26, ELECTRICAL and Division 28 ELECTRONIC SAFETY AND SECURITY sections for:
 - 1. Conduit, junction boxes and wire pulls.
 - 2. Connections to and from power supplies to electrified hardware.
 - 3. Connections to fire/smoke alarm system and smoke evacuation system.
 - 4. Connection of wire to door position switches and wire runs to central room or area, as directed by Architect.
 - 5. Connections to panel interface modules, controllers, and gateways.
 - 6. Testing and labeling wires with Architect's opening number.
- J. Key Control System: Tag keys and place them on markers and hooks in key control system cabinet, as determined by final keying schedule.
- K. Door Closers: Mount closers on room side of corridor doors, inside of exterior doors, and stair side of stairway doors from corridors. Mount closers so they are not visible in corridors, lobbies and other public spaces unless approved by Architect.
- L. Closer/Holders: Mount closer/holders on room side of corridor doors, inside of exterior doors, and stair side of stairway doors.
- M. Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room, or alternate location as directed by Architect.
- N. Thresholds: Set thresholds in full bed of sealant complying with requirements specified in Division 07 Section "Joint Sealants."
- O. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they may impede traffic or present tripping hazard.
- P. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- Q. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- R. Door Bottoms and Sweeps: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Spring Hinges: Adjust to achieve positive latching when door can close freely from an open position of 30 degrees.
 - 2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 3. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately three to six months after date of Substantial Completion, examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors and door hardware.

3.05 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items per manufacturer's instructions to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

- A. The intent of the hardware specification is to specify the hardware for interior and exterior doors, and to establish a type, continuity, and standard of quality. However, it is the door hardware supplier's responsibility to thoroughly review existing conditions, schedules, specifications, drawings, and other Contract Documents to verify the suitability of the hardware specified.
- B. Discrepancies, conflicting hardware, and missing items are to be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application.
- C. Hardware items are referenced in the following hardware schedule. Refer to the above specifications for special features, options, cylinders/keying, and other requirements.
- D. Hardware Sets: refer to other document

END OF SECTION

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Hardware Group No. 1 CR - REUSE EXISTING CARD READER. IF DOOR/FRAME HAS EXISTING PREPS, PLEASE MATCH EXISTING.

For use on Door #(s): NG016-4

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ)		652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 TW8	×	652	IVE
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM (SFIC)			
1	EA	EU STOREROOM LOCK	ND80EU SPA RX	×	626	SCH
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
1	EA	DOOR POSITION SWITCH	PROVIDED BY SECURITY CONTRACTOR	×		
1	EA	LOW VOLTAGE POWER	PROVIDED BY SECURITY CONTRACTOR	M		

DOOR IS NORMALLY LOCKED AND CLOSED. DOOR IS ALWAYS FREE FOR EGRESS. AUTHORIZED CREDENTIAL TO CARD READER MOMENTARILY RELEASES LEVER ON LOCK ALLOWING ENTRY. MECHANICAL KEY OVERRIDE UPON LOSS OF POWER, LOCK IS FAIL SECURE AND WILL REMAIN LATCHED. Hardware Group No. ALTERNATE 2CR

For use on Door #(s): TRAINING ALTERNATE

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	INTERIOR HINGE	5BB1 (SIZE, QTY, WEIGHT, NRP AS REQ)		652	IVE
1	EA	ELECTRIC HINGE	5BB1HW 5 X 4.5 TW8	×	652	IVE
1	EA	EU MORTISE LOCK	L9095EU 07 12/24 VDC	×	626	SCH
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM (SFIC)			
1	EA	SURFACE CLOSER	4040XP SCUSH		689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW B-CS		630	IVE
1	EA	GASKETING	188SBK PSA		BK	ZER
2	EA	CREDENTIAL READER	PROVIDED BY SECURITY CONTRACTOR	×		
1	EA	DOOR POSITION SWITCH	PROVIDED BY SECURITY CONTRACTOR	×		
1	EA	LOW VOLTAGE POWER	PROVIDED BY SECURITY CONTRACTOR	N		

DOOR IS NORMALLY LOCKED AND CLOSED. DOOR IS NOT FREE FOR EGRESS. AUTHORIZED CREDENTIAL TO EITHER CARD READER MOMENTARILY RELEASES CORRESPONDING LEVER ON LOCK ALLOWING ENTRY. MECHANICAL KEY OVERRIDE UPON LOSS OF POWER, LOCK IS FAIL SECURE AND WILL REMAIN LATCHED.

Hardware Group No. COMMUNICATING - Not Used

Hardware Group No. E-01 - REUSE ALL EXISTING HARDWARE

For use on Door #(s): NG015-1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	CYLINDER(S)	MATCH EXISTING KEY SYSTEM		
			(SFIC)		

Hardware Group No. E-02 - REUSE EXISTING HARDWARE

For use on Door #(s): NG015-2

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	EA	CREDENTIAL READER	PROVIDED BY SECURITY	×		
			CONTRACTOR			

University of Colorado - Denver Anschutz Medical Campus Fitz Bldg Grnd NG015, NG016 Reno

Door#	HwSet#
NG015-1	E-01
NG015-2	E-02
NG016-4	1 CR

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SECTION 088000 - GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Glass for doors, interior borrowed lites.
 - 2. Glazing sealants and accessories.
- B. Related Requirements:
 - 1. Section 081113 "Hollow Metal Doors and Fames" for hollow metal doors and frames to receive glazing specified in this Section.
 - 2. Section 081416 "Flush Wood Doors" for flush wood doors to receive glazing specified in this Section.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- C. IBC: International Building Code.
- D. Interspace: Space between lites of an insulating-glass unit.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Glass Product: Subject to compliance with requirements, provide product indicated in glass schedule at the end of this Section, or comparable product by one of the following:
 - 1. Guardian Industries Corp.
 - 2. Viracon, Inc.
 - 3. Vitro S.A.B. de C.V. (formerly PPG).
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined according to the IBC and ASTM E 1300. Glazing requiring structural evaluation beyond the scope of the graphical analysis procedure ("Basic Procedure") within ASTM E 1300 shall be properly evaluated through finite element analyses per IBC Chapter 24 "Glass and Glazing" as performed by a registered design professional. Implement edge captures with sufficient engagement to ensure that the glazing remains retained under all design service conditions and with a margin of safety.
 - 1. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
- C. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- D. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
 - 2. IGMA Publication: "IGMA Technical Binder."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than the thickness indicated.
 - 1. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- D. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C 1036, Type I, Class 1 (clear), Quality-Q3.

- B. Fully Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

2.5 GLAZING SEALANTS

A. General:

- 1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- 3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. Low-Emitting Adhesives and Sealants: Provide products that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- C. Glazing Sealant: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 995.

2.6 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore A Durometer hardness of 85, plus or minus 5.
- D. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- E. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.7 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
 - 1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.
 - a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications. Maintain consistency with applicable guidance published by the Glazing Association of North America.

- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Where temporary construction films are necessary to protect the glazing, the films shall be transparent and colorless in order to limit the potential for induced thermal stress breakage of the glass.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- 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. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- K. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- L. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.5 CLEANING AND PROTECTION

- A. Immediately after installation remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.6 MONOLITHIC GLASS SCHEDULE

- A. GLASS TYPE GL-MC (T): Clear, fully tempered float glass.
 - 1. Minimum thickness: 6.0 mm.
 - 2. Provide safety glazing labeling.

END OF SECTION 088000

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SECTION 088813 - FIRE-RESISTANT GLAZING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection-rated glazing.
 - 2. Fire-resistance-rated glazing.

1.3 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.
- B. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.

1.4 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Glass Samples: For each type of glass product; 12 inches square.
- C. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of glass and glazing product, from manufacturer.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install fire-resistant glazing until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
- B. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, or installation; deterioration of glazing materials; or other defects in construction.
- B. Recycled Content: Provide materials/products that have post- and/or pre-consumer recycled content, by weight of total product.

2.3 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organization below unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
 - 1. GANA Publications: "Laminated Glazing Reference Manual" and "Glazing Manual."
- B. Safety Glazing Labeling: Permanently mark glazing with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, glass thickness, and safety glazing standard with which glass complies.

2.4 GLASS PRODUCTS

- A. Float Glass: ASTM C 1036, Type I, Quality-Q3, Class I (clear) unless otherwise indicated.
- B. Tempered Float Glass: ASTM C 1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class I (clear) unless otherwise indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
- C. Laminated Glass: ASTM C 1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.
 - 1. Construction: Laminate glass with polyvinyl butyral interlayer unless fire-protection or fire-resistance rating is based on another product.
 - 2. Interlayer Thickness: Provide thickness as needed to comply with requirements.
 - 3. Interlayer Color: Clear unless otherwise indicated.

2.5 FIRE-PROTECTION-RATED GLAZING GL-F1

- A. Fire-Protection-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on positive-pressure testing according to NFPA 257 or UL 9, including the hose-stream test, and shall comply with NFPA 80.
 - 1. Fire-protection-rated glazing required to have a fire-protection rating of 20 minutes shall be exempt from the hose-stream test.
- B. Fire-Protection-Rated Glazing Labeling: Permanently mark fire-protection-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name; test standard; whether glazing is permitted to be used in doors or openings; if permitted in openings, whether or not glazing has passed the hose-stream test; whether or not glazing meets 450 deg F (250 deg C) temperature-rise limitation; and the fire-resistance rating in minutes.
- C. Fire-Protection-Rated Tempered Glass: thickness, fire-protection-rated tempered glass; and complying with 16 CFR 1201, Category II.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Safti First Fire Rated Glazing Solutions; .
 - b. Technical Glass Products; Fireglass20.
 - c. Vetrotech Saint-Gobain; SSG Pyroswiss US.
- D. Film-Faced Ceramic Glazing: Clear, ceramic flat glass; 5-mm thickness; faced on one surface with a clear glazing film; and complying with 16 CFR 1201, Category II.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Safti First Fire Rated Glazing Solutions; Pyran Platinum F.

- b. Technical Glass Products; FireLite NT.
- c. Vetrotech Saint-Gobain; SGG Keralite FR-F.
- E. Laminated Ceramic Glazing: Laminated glass made from two plies of clear, ceramic glass; 8-mm total thickness; and complying with 16 CFR 1201, Category II.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Safti First Fire Rated Glazing Solutions; Pyran Platinum L
 - b. Technical Glass Products; FireLite Plus.
 - c. Vetrotech Saint-Gobain; SGG Keralite FR-L.
- F. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pilkington North America; Pyrostop.
 - b. Technical Glass Products; Pyrostop.
 - c. Vetrotech Saint-Gobain; Contraflam.

2.6 FIRE-RESISTANCE-RATED GLAZING GL-F2

- A. Fire-Resistance-Rated Glazing: Listed and labeled by a testing agency acceptable to authorities having jurisdiction, for fire-resistance ratings indicated, based on testing according to ASTM E 119 or UL 263.
- B. Fire-Resistance-Rated Glazing Labeling: Permanently mark fire-resistance-rated glazing with certification label of a testing agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, test standard, that the glazing is approved for use in walls, and the fire-resistance rating in minutes.
- C. Laminated Glass with Intumescent Interlayers: Laminated glass made from multiple plies of uncoated, ultraclear float glass; with intumescent interlayers; and complying with 16 CFR 1201, Category II.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Pilkington North America; Pyrostop.
 - b. Technical Glass Products; Pyrostop.
 - c. Vetrotech Saint-Gobain; SGG Contraflam.

2.7 GLAZING ACCESSORIES

A. Provide glazing gaskets, glazing sealants, glazing tapes, setting blocks, spacers, edge blocks, and other glazing accessories that are compatible with glazing products and each other and are approved by testing agencies that listed and labeled fire-resistant glazing products with which products are used for applications and fire-protection ratings indicated.

- B. Glazing Sealants for Fire-Rated Glazing Products: Neutral-curing silicone glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 50, Use NT. Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated.
 - Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
 - 2. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.8 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with manufacturing and installation tolerances, including those for size, squareness, and offsets at corners, and for compliance with minimum required face and edge clearances.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate fire side and protected side. Label or mark units as needed so that fire side and protected side are readily identifiable. Do not use materials that leave visible marks in the completed work.

3.3 GLAZING, GENERAL

- A. Use methods approved by testing agencies that listed and labeled fire-resistant glazing products.
- B. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials unless more stringent requirements are indicated, including those in referenced glazing publications.

- C. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.
- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- E. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- 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. Set glass lites with proper orientation so that coatings face fire side or protected side as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

3.4 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended in writing by glass manufacturer.
- C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces in each area of Project not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

END OF SECTION 088813

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SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Studs and Runners: Provide documentation that framing members' certification is according to SIFA's "Code Compliance Certification Program for Cold-Formed Steel Structural and Non-Structural Framing Members."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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 E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. .
 - 1. Provide deflection limit of 1/360 for walls finished with ceramic tiling.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.

- 2. Protective Coating: ASTM A 653/A 653M, G40 , hot-dip galvanized unless otherwise indicated.
- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or embossed steel studs and runners.
 - 1. Steel Studs and Runners:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MBA Building Supplies.
 - 4) Phillips Manufacturing Co.
 - 5) Steel Network, Inc. (The).
 - 6) Telling Industries.
 - b. Minimum Base-Metal Thickness: As required by performance requirements for horizontal deflection.
 - 1) Provide not less than 20 ga. studs behind surfaces indicated to have tile or wall-hung cabinets.
 - c. Depth: As indicated on Drawings.
 - 2. Embossed Steel Studs and Runners:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) CEMCO; California Expanded Metal Products Co.
 - 2) ClarkDietrich Building Systems.
 - 3) MarinoWARE.
 - 4) MBA Building Supplies.
 - 5) Phillips Manufacturing Co.
 - 6) Steel Network, Inc. (The).
 - 7) Telling Industries.
 - b. Minimum Base-Metal Thickness: As required by horizontal deflection performance requirements.
 - 1) Provide not less than 20 ga. studs behind surfaces indicated to have tile or wall-hung cabinets.
 - c. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer runner sized to friction fit inside runner.
 - 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- D. Firestop Deflection Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Blazeframe Industries; Intumescent Framing, Fire Stop System.
 - b. CEMCO; California Expanded Metal Products Co.; FAS Track.
 - c. Fire Trak Corp; Fire Trak System attached to studs with Fire Trak Posi Klip.
- E. Backing Track: Steel track for blocking and bracing cabinets and equipment.
 - 1. Provide 0.0478 inch (18 gauge) x 6 inch wide backing track extended to nearest stud past cabinet or equipment on both sides. Secure backing to stud with (3) #10 SMS per stud, typical.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Metal Thickness: 0.0478 inch (18 gauge).
- G. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inchwide flanges.
 - 1. Depth: As indicated on Drawings.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- diameter wire, or double strand of 0.048-inch- diameter wire.
- B. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- C. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch- wide flanges.
 - 1. Depth: 1-1/2 inches .

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 - 1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 - 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 - 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 - 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
 - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 - 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
 - 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 - 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING SUSPENSION SYSTEMS

- A. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- B. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.

- 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
- 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
- 4. Do not attach hangers to steel roof deck.
- 5. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
- 6. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
- 7. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- C. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- D. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 092900 - GYPSUM BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Interior gypsum board.
 - 2. Sound-attenuation blankets.
- B. Related Requirements:
 - 1. Section 079219 "Acoustical Joint Sealants" for acoustical sealants in gypsum board walls.
 - 2. Section 092216 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include product data indicating compliance with UL Assemblies indicated on Drawings.

1.4 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- 2.2 GYPSUM BOARD, GENERAL
 - A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.
- 2.3 INTERIOR GYPSUM BOARD
 - A. Gypsum Board, Type X: ASTM C 1396/C 1396M.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. American Gypsum.
 - b. CertainTeed Corporation.
 - c. Georgia-Pacific Building Products.
 - d. National Gypsum Company.
 - e. PABCO Gypsum.
 - f. USG.
 - 2. Thickness: 5/8 inch.
 - 3. Long Edges: Tapered.

2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 - 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet.
 - 2. Shapes:
 - a. Cornerbead.
 - b. Curved-Edge Cornerbead: With notched or flexible flanges.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint beads.

- 1) Architectural intersections.
 - a) Where vertical and horizontal expansion (control) joints intersect, provide manufacturer's fabricated architectural intersection bead to match expansion (control) joint bead profile.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Fry Reglet Corporation.
 - b. Gordon, Inc.
 - c. Pittcon Industries.
 - 2. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B 221, Alloy 6063-T5.
 - 3. Finish: As indicated on Drawings.

2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 - 1. Interior Gypsum Board: Paper.
- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.
 - 1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
 - 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 - 3. Fill Coat: For second coat, use compound.
 - 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
 - 5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
 - 1. Adhesives shall have a VOC content of 50 g/L or less.

- Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- C. Steel Drill Screws: ASTM C 1002 unless otherwise indicated.
 - 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 - 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound-Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
 - 1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- C. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- D. Form control and expansion joints with space between edges of adjoining gypsum panels.
- E. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.

- 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- F. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- G. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- H. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- I. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
 - 1. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- B. Multilayer Application:
 - 1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.

3.4 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings and according to ASTM C 840 and in specific locations approved by Architect for visual effect.

- C. Interior Trim: Install in the following locations:
 - 1. Cornerbead: Use at outside corners unless otherwise indicated.
 - 2. Curved-Edge Cornerbead: Use at curved openings.
 - 3. LC-Bead: Use at exposed panel edges.
 - 4. L-Bead: Use where indicated.
 - 5. U-Bead: Use where indicated.
 - 6. Shadow and Reveal Beads: Use where indicated.
- D. Aluminum Trim: Install in locations indicated on Drawings.

3.5 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Where indicated on Drawings.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - 5. Level 5: Where indicated on Drawings.

3.6 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 093013 - CERAMIC TILING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Porcelain floor tile.
 - 2. Crack isolation membrane.
 - 3. Metal edge strips.
- B. Related Requirements:
 - 1. Section 079200 "Joint Sealants" for sealing of expansion, contraction, control, and isolation joints in tile surfaces.

1.3 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- ANSI A108 Series: ANSI A108.01, ANSI A108.02, ANSI A108.1A, ANSI A108.1B, ANSI A108.1C, ANSI A108.4, ANSI A108.5, ANSI A108.6, ANSI A108.8, ANSI A108.9, ANSI A108.10, ANSI A108.11, ANSI A108.12, ANSI A108.13, ANSI A108.14, ANSI A108.15, ANSI A108.16, and ANSI A108.17, which are contained in its "Specifications for Installation of Ceramic Tile."
- C. Module Size: Actual tile size plus joint width indicated.
- D. Face Size: Actual tile size, excluding spacer lugs.
- E. Large and Heavy Tiles (LHT): Tiles with at least one side greater than 15 inches and/or weighing over 5 pounds per square foot.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

- D. Samples for Verification:
 - 1. Full-size units of each type and composition of tile and for each color and finish required.
 - 2. Full-size units of each type of trim and accessory for each color and finish required.
 - 3. Metal edge strips in 6-inch lengths.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Installer is a five-star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
 - B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
 - C. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.
 - D. Store liquid materials in unopened containers and protected from freezing.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain from single source or producer.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.
 - 1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 - 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:

1. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
 - 1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Factory Blending: For tile exhibiting color variations within ranges, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
 - 1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in-service performance.

2.3 TILE PRODUCTS

- A. Ceramic Tile Type: Unglazed porcelain floor tile.
 - 1. Manufacturers: Subject to compliance with requirements, provide product indicated on Drawings or approved substitution.
 - 2. Certification: Tile certified by the Porcelain Tile Certification Agency.
 - Face Size: As indicated on Drawings 3 by 3 inches 4 by 4 inches 6 by 6 inches 7-3/4 by 3-7/8 inches 7-7/8 by 7-7/8 inches 11-13/16 by 11-13/16 inches 165 by 333 mm 200 by 250 mm 250 by 250 mm 333 by 333 mm.
 - 4. Thickness: As indicated on Drawings.
 - 5. Face: As indicated on Drawings.
 - 6. Dynamic Coefficient of Friction: Not less than 0.42 as measured per the DCOF AcuTest contained in ANSI A137.1-2012, Section 9.6.
 - 7. Tile Color, Glaze, and Pattern: As indicated on Drawings.
 - 8. Grout Color: As indicated on Drawings.
 - 9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. As indicated on Drawings.

2.4 CRACK ISOLATION MEMBRANE

A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

- B. Chlorinated Polyethylene Sheet: Nonplasticized, chlorinated polyethylene faced on both sides with nonwoven polyester fabric; 0.030-inch nominal thickness.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Noble Company (The); Nobleseal CIS.

2.5 SETTING MATERIALS

- A. LHT (formerly medium-bed) Improved Modified Dry-Set Mortar (Thinset): ANSI A118.15; Provide product that is approved by manufacturer for application thickness of up to 3/4 inch.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; ProLite Premium Large Format Tile Mortar.
 - b. Laticrete International, Inc; Laticrete 4 XLT.
 - c. MAPEI Corporation; MAPEI ULtraflex LFT.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.15.

2.6 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Custom Building Products; Prism Color Consistent Grout.
 - b. Laticrete International, Inc; Laticrete PERMACOLOR Select.
 - c. MAPEI Corporation; MAPEI Ultracolor Plus.

2.7 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Metal Edge Strips: Angle or L-shaped, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; Finish as indicated on drawings, exposed-edge material.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated on Drawings or comparable products by one of the following:
 - a. Blanke Corporation.
 - b. Profilitec.
 - c. Schluter Systems L.P.
 - 2. For bevel face tiles, provide metal edge strip height to match cut edge thickness.

- 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.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Aqua Mix Concentrated Stone & Tile Cleaner.
- D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Custom Building Products; Aqua Mix Sealer's Choice Gold.
 - Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

2.8 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 - 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
 - 2. Verify that concrete substrates for tile floors installed with bonded mortar bed or thinset mortar comply with surface finish requirements in ANSI A108.01 for installations indicated.

- a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
- b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
- 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
- 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thinset mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 CERAMIC TILE INSTALLATION

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors consisting of tiles 8 by 8 inches or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Where accent tile differs in thickness from field tile, vary setting-bed thickness so that tiles are flush.

- F. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
 - 1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 - 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 - 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- G. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Porcelain Floor Tile:As indicated on Drawings.
 - 2. Perimeter Movement Joints (Sealant): Not less than 1/4 inch.
 - 3. Movement Joints at Change-of-Plane (Sealant): Same as grout joint but not less than 1/8 inch.
- H. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- I. Perimeter Movement Joints: Provide perimeter movement joints as described in TCNA EJ171 including as follows:
 - 1. Where tilework abuts restraining surfaces such as perimeter walls, dissimilar floor finishes, curbs, columns, pipes, ceilings and where changes occur in backing materials, but not at drain strainers.
 - 2. Inside corners in interior and exterior tilework.
 - 3. Outside corners at exterior tilework only.
- J. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated on Drawings. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
- K. Metal Edge Strips: Install where indicated on Drawings.
- L. Sealer: Apply sealer to cementitious grout joints in tile according to sealer manufacturer's written instructions. As soon as sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.

3.4 CRACK ISOLATION MEMBRANE INSTALLATION

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.5 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate evidence of replacement.
- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.6 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed.
- C. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

3.7 INTERIOR CERAMIC TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Ceramic Tile Installation: TCNA F113; thinset mortar.
 - a. Ceramic Tile Type: Large and Heavy Tile (LHT) on floors.
 - b. Thinset Mortar: Medium-bed, Improved modified dry-set mortar.
 - c. Grout: High-performance grout.
 - d. Locations: At typical large and heavy tile (LHT) floor locations, except as specified otherwise.
 - 2. Ceramic Tile Installation: TCNA F125-Partial; thinset mortar on crack isolation membrane.
 - a. Ceramic Tile Type: Ceramic floor tile.
 - b. Thinset Mortar: As specified in other installations.
 - c. Grout: As specified in other installations.
 - d. Crack Isolation Membrane: as specified.
 - e. Locations: Install under floor tile at cracks and control joints in concrete slab.

END OF SECTION 093013

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SECTION 095113 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes:
 - 1. Acoustical panels and exposed suspension systems for interior ceilings.
 - 2. Metal edge moldings and trim.
- B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: For finishes to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Acoustical Ceiling Units: Full-size panels equal to 1 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
 - 1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Low-Emitting Ceiling Materials: Provide materials/products, installed within the weatherproofing system, that comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- B. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: Class A according to ASTM E 1264.
 - 2. Smoke-Developed Index: 50 or less.
- C. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL or from the listings of another qualified testing agency.
- D. Antimicrobial Treatment: Manufacturer's standard broad spectrum, antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273, ASTM D 3274, or ASTM G 21 and evaluated according to ASTM D 3274 or ASTM G 21.

2.3 ACOUSTICAL PANELS

- A. Basis-of-Design Product(s): Subject to compliance with requirements, provide product(s) indicated on Drawings, or comparable product(s) by one of the following:
 - 1. Armstrong World Industries, Inc.

- a. Contact Kelly Hedlund, kshedlund@armstrongceilings.com.
- 2. CertainTeed Corporation.
- 3. Chicago Metallic Corporation.
- 4. Rockfon, part of the Rockwool Group.
- 5. United States Gypsum Company.
- B. Acoustical Panel Standard: Provide manufacturer's standard panels according to ASTM E 1264 and designated by type, form, pattern, acoustical rating, and light reflectance unless otherwise indicated.

2.4 METAL SUSPENSION SYSTEM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in this Section or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. Chicago Metallic Corporation.
 - 4. United States Gypsum Company.
- B. Metal Suspension-System Standard: Provide manufacturer's standard, direct-hung, metal suspension system and accessories according to ASTM C 635/C 635M and designated by type, structural classification, and finish indicated.
 - 1. High-Humidity Finish: Where indicated, provide coating tested and classified for "severe environment performance" according to ASTM C 635/C 635M.
- C. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet; prepainted, electrolytically zinc coated, or hot-dip galvanized, G30 coating designation; with prefinished 15/16-inch- wide metal caps on flanges.
 - 1. Structural Classification: Intermediate-duty system.
 - 2. Face Design: Flat, flush.
 - 3. Cap Material: Cold-rolled steel.
 - 4. Cap Finish: Painted.

2.5 ACCESSORIES

- A. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
- B. Wire Hangers, Braces, and Ties: Provide wires as follows:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.106-inch- diameter wire.

2.6 METAL EDGE MOLDINGS AND TRIM

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in this Section, or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. CertainTeed Corporation.
 - 3. United States Gypsum Company.
- B. Extruded-Aluminum Edge Moldings and Trim: Where indicated, provide manufacturer's extruded-aluminum edge moldings and trim of profile indicated or referenced by manufacturer's designations, including splice plates, corner pieces, and attachment and other clips, complying with seismic design requirements.
 - 1. Baked-Enamel or Powder-Coat Finish: Minimum dry film thickness of 1.5 mils . Comply with ASTM C 635/C 635M and coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 2. Color: As indicated.
 - 3. Shape: Straight and/or curved, as indicated on Drawings.

2.7 ACOUSTICAL SEALANT

- A. Acoustical Sealant: As specified in Section 079219 "Acoustical Joint Sealants."
 - Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.
- B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION

- A. Install acoustical panel ceilings according to ASTM C 636/C 636M and manufacturer's written instructions.
 - 1. Fire-Rated Assembly: Install fire-rated ceiling systems according to tested fire-rated design.
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required and, if permitted with fire-resistance-rated ceilings, to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
 - 5. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved. Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
 - 6. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 - 7. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 - 8. Do not attach hangers to steel deck tabs.
 - 9. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 - 10. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 - 11. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

- 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
- 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
- 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.
 - 1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 - 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
 - 4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
 - 5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
 - 6. Protect lighting fixtures and air ducts according to requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

- A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.
- B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.
- B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Resilient base.
 - 2. Resilient molding accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples.
- C. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.
- B. Transport resilient moldings in a manner to minimize stretching. Do not carry over-the-shoulder.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following time periods:

- 1. 48 hours before installation.
- 2. During installation.
- 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Low-Emitting Adhesives and Sealants: Adhesives and Sealants applied on site within the weatherproofing system in this Section must comply with South Coast Air Quality Management District Rule 1168 for VOC content. Products must also comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

2.2 THERMOPLASTIC-RUBBER BASE

- A. Manufacturers: Subject to compliance with requirements, provide products indicated on Drawings or comparable product by one of the following:
 - 1. Armstrong World Industries, Inc.
 - 2. Johnsonite; A Tarkett Company.
 - 3. Mondo Rubber International, Inc.
 - 4. Roppe Corporation, USA.
- B. Product Standard: ASTM F 1861, Type TP (rubber, thermoplastic).
 - 1. Group: I (solid, homogeneous).
 - 2. Style and Location:
 - a. Style B, Cove: Provide where indicated on Drawings.
- C. Thickness: 0.125 inch.
- D. Height: As indicated on Drawings.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.
- H. Colors: As indicated on Drawings.

2.3 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Roppe Corporation, USA.
 - 2. Tarkett.
 - 3. VPI, LLC, Floor Products Division.
- B. Description: Rubber transition strips.
- C. Profile and Dimensions: As indicated on Drawings.
- D. Locations: Provide rubber molding accessories in areas indicated on Drawings.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.4 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.
 - 1. Provide low-emitting adhesives.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

- B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- C. Do not install resilient products until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.
- D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.
 - 1. Begin installation of resilient moldings only after the work of all other trades have been completed.
 - 2. Do not stretch transitional moldings during delivery or installation, to avoid gaps that will need to be reworked under warranty.
 - a. Maximum allowable gap after 6 months is 1/16 inch.
 - 3. Areas to receive resilient moldings shall be clean, fully enclosed, weathertight, and maintained at uniform temperature of at least 65 degrees for 24 hours before, during, and after the installation is competed. Condition transitional moldings and adhesives in the same manner.

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4. Provide a floor surface that is smooth, flat, level, permanently dry, clean, and free of all foreign material such as dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt, and old adhesive residue.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
- C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 096513

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SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Luxury vinyl tile (LVT)
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for rubber floor transitions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
- C. Product Schedule: For floor tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Testing Results: For alkalinity and adhesion testing, and moisture testing, including anhydrous calcium chloride test and relative humidity test.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs workers for this Project who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.9 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following time periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Low-Emitting Materials: Flooring system shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.2 LUXURY VINYL FLOOR TILE

- A. Products: Subject to compliance with requirements, provide products indicated on Drawings or approved substitution by one of the following:
 - 1. AB; American Biltrite.
 - 2. Altro Group.
 - 3. Amtico International Inc.
 - 4. Armstrong World Industries, Inc.
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- 5. Burke Mercer Flooring Products, Division of Burke Industries Inc.
- 6. Flexco, Inc.
- 7. Flooret.
- 8. Gerflor.
- 9. Johnsonite; A Tarkett Company.
- 10. Mannington.
- 11. Mohawk Group.
- 12. Polyflor, Ltd.
- 13. Roppe Corporation, USA.
- 14. Shaw Industries, Inc.
- 15. TOLI International.
- B. Tile Standard: ASTM F 1700.
 - 1. Class: As indicated by product designations.
 - 2. Type: A, smooth surface.
- C. Thickness: As indicated on Drawings.
- D. Size: As indicated on Drawings.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.
 - 1. Provide adhesive for use over high-moisture concrete slabs when required by moisture testing results.
 - 2. Adhesives shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to floor tile manufacturer's written recommendations, but not less stringent than the following:
 - a. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are the same temperature as the space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.
- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles in pattern indicated on Drawings.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles in pattern of colors and sizes indicated on Drawings.

- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.
- B. Perform the following operations immediately after completing floor tile installation:
 - 1. Remove adhesive and other blemishes from exposed surfaces.
 - 2. Sweep and vacuum surfaces thoroughly.
 - 3. Damp-mop surfaces to remove marks and soil.
- C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover floor tile until Substantial Completion.

END OF SECTION 096519

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SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes modular carpet tile.
- B. Related Requirements:
 - 1. Section 096513 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.
 - 8. Type, color, and location of insets and borders.
 - 9. Type, color, and location of edge, transition, and other accessory strips.
 - 10. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
 - 1. Carpet Tile: Full-size Sample.
 - 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch- long Samples.
- D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- B. Testing Results: For alkalinity and adhesion testing, and moisture testing, including anhydrous calcium chloride test and relative humidity test.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 - 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 - 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- 1.7 DELIVERY, STORAGE, AND HANDLING
 - A. Comply with CRI's "CRI Carpet Installation Standard."

1.8 FIELD CONDITIONS

- A. Comply with CRI's "CRI Carpet Installation Standard" for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.9 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

- 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
- 2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.
- 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved substitution.
- B. Primary Backing/Backcoating: Manufacturer's standard composite materials .

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.
 - 1. Low-Emitting Adhesives and Sealants: Adhesives and sealants applied on site within the weatherproofing system in this Section must comply with South Coast Air Quality Management District Rule 1168 for VOC content. Products must also comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.

- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 033000 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with CRI's "CRI Carpet Installation Standards" and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Metal Substrates: Clean grease, oil, soil and rust, and prime if recommended in writing by adhesive manufacturer. Rough sand painted metal surfaces and remove loose paint. Sand aluminum surfaces, to remove metal oxides, immediately before applying adhesive.
- E. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with CRI's "CRI Carpet Installation Standard," Section 18, "Modular Carpet" and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns indicated on Drawings.

- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with CRI's "CRI Carpet Installation Standard," Section 20, "Protecting Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 096813

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SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on the following interior substrates:
 - 1. Steel and iron.
 - 2. Gypsum board.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for shop priming metal fabrications.

1.3 DEFINITIONS

- A. Coat of Paint: An application of paint, applied not less than the manufacturer's recommended duration for recoat based on relative humidity and ambient temperature.
- B. MPI Gloss Level 1 (Flat): Not more than five units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- C. MPI Gloss Level 2 (Low Sheen): Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. MPI Gloss Level 3 (Eggshell): 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- E. MPI Gloss Level 4 (Satin): 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- F. MPI Gloss Level 5 (Semi-Gloss): 35 to 70 units at 60 degrees, according to ASTM D 523.
- G. MPI Gloss Level 6 (Gloss): 70 to 85 units at 60 degrees, according to ASTM D 523.
- H. MPI Gloss Level 7 (High-Gloss): More than 85 units at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

- 1. Indicate VOC content.
- B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- C. Product List: Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

1.7 FIELD CONDITIONS

- A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide basis-of-design products indicated in this Section, or approved substitutions by one of the following :
 - 1. Benjamin Moore & Co.
 - 2. PPG Paints.
 - 3. Sherwin-Williams Company (The).

- 2.2 PAINT, GENERAL
 - A. Material Compatibility:
 - 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.
 - B. Colors: As indicated on Drawings.

2.3 SOURCE QUALITY CONTROL

- A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage the services of a qualified testing agency to sample paint materials. Contractor will be notified in advance and may be present when samples are taken. If paint materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Gypsum Board: 12 percent.
- C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.
- D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- E. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:
 - 1. SSPC-SP 2.
 - 2. SSPC-SP 3.
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
 - Apply coats of paint per manufacturer's recommendations based on relative humidity and ambient temperature, but not less than 24-48 hours between coats for temperatures below 45 degrees F, and not less than 4 hours between coats applied above 45 degrees F.
 - 2. Use applicators and techniques suited for paint and substrate indicated.
 - 3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 5. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
 - 6. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- B. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- D. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Tanks that do not have factory-applied final finishes.
 - b. Natural gas lines, if any.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.
- B. All Surfaces, preparation, and paint applications may be inspected.
- C. Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Painting Inspection Agency inspector:
 - 1. Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by inefficient application methods, skipped or missed areas, and foreign materials in paint coatings.
 - 2. Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and reentrant angles.
 - 3. Damage due to touching before paint is sufficiently dry or any other contributory cause.
 - 4. Damage due to application on moist surfaces or caused by inadequate protection from the weather.
 - 5. Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).

- D. Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces:
 - 1. Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - 2. Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 39 inches.
 - 3. Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - 4. When the final coat on any surface exhibits a lack of uniformity of color, sheen, texture, and hiding across full surface area.
- E. Painted surfaces rejected by the inspector shall be made good at the expense of the Contractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags of damaged paint shall be removed by scraper or by sanding prior to application of paint.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.
 - 1. Extend paint to from wall corner-to-corner, or corner-to-control-joint, or control-joint-to control-joint, when touch-up extents are otherwise visible.

3.6 INTERIOR PAINTING SCHEDULE

- A. Steel Substrates:
 - 1. High-Performance Architectural Latex System:
 - a. Prime Coat: Shop primer specified in Section where substrate is specified.
 - b. Intermediate Coat: Latex, interior, high performance architectural, matching topcoat.
 - c. Topcoat: Latex, interior, high performance architectural, semi-gloss (MPI Gloss Level 5).
 - 1) Benjamin Moore: Ultra Spec HP D.T.M. Acrylic Semi-Gloss HP29, at 4.0-5.4 mils wet, 1.8-2.5 mils dry, per coat.

- 2) PPG Paints: Pitt-Glaze WB-1, Pre-Catalyzed Acrylic Semi-Gloss Epoxy, 16-510 Series; applied at 1.5 mils dft per coat.
- 3) Sherwin-Williams: Pro Industrial Acrylic Semi-Gloss Coating, B66-650 Series, at 2.5 to 4.0 mils dry, per coat.
- d. Location(s): Hollow metal doors and frames, wall grilles, other steel/iron except as noted.
- B. Gypsum Board Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC.
 - 1) Benjamin Moore: Ultra Spec 500 Waterborne Interior Primer N534/K534.
 - 2) PPG Paints: Speedhide Zero Interior Latex Sealer, 6-4900XI Series; applied at 1.4 mils dft.
 - 3) Sherwin-Williams: ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.5 mils dry.
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, eggshell (MPI Gloss Level 3) .
 - 1) Benjamin Moore: Ultra Spec 500 Eggshell, 4.3 mils wet, 1.8 mils dry per coat.
 - 2) PPG Paints: Speedhide Zero Interior Latex Eggshell, 6-4310XI Series; applied at 1.4 mils dft per coat.
 - 3) Sherwin-Williams: ProMar 200 Zero VOC Latex Eg-Shel, B20-12600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.
 - d. Location(s): Typical gypsum board paint, except as otherwise noted.

END OF SECTION 099123

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SECTION 101100 - VISUAL DISPLAY UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Visual display board assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and accessories for visual display units.
 - 2. Include electrical characteristics for motorized units.
- B. Shop Drawings: For visual display units.
 - 1. Include plans, elevations, sections, details, and attachment to other work.
 - 2. Show locations of panel joints.
 - 3. Include sections of typical trim members.
 - 4. Include wiring diagrams for power and control wiring.
- C. Samples for Verification: For each type of visual display unit indicated.
- D. Product Schedule: For visual display units. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For visual display units to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated visual display units completely assembled in one piece. If dimensions exceed maximum manufactured unit size, or if unit size is impracticable to ship in one piece, provide two or more pieces with joints in locations indicated on approved Shop Drawings.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install visual display units until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- B. Field Measurements: Verify actual dimensions of construction contiguous with visual display units by field measurements before fabrication.
 - 1. Allow for trimming and fitting where taking field measurements before fabrication might delay the Work.

1.8 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Surfaces lose original writing and erasing qualities.
 - b. Surfaces exhibit crazing, cracking, or flaking.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 VISUAL DISPLAY BOARD ASSEMBLY

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings, or comparable product by one of the following:

- 1. Claridge Products and Equipment, Inc.
- 2. Clarus Glassboards LLC.
- 3. Egan Visual Inc.
- 4. Marsh Industries, Inc.; Visual Products Group.
- 5. Peter Pepper Products, Inc.
- B. Visual Display Board Assembly: factory fabricated.
 - 1. Assembly: Markerboard and Tackboard.
 - 2. Corners: Square.
 - 3. Width: As indicated on Drawings.
 - 4. Height: As indicated on Drawings.
 - 5. Mounting Method: Mechanically fastened with concealed fasteners.
- C. Markerboard Panel: Porcelain-enamel-faced markerboard panel on core indicated.
 - 1. Color: As selected by Architect from full range of industry colors.
- D. Tackboard Panel: Natural-cork tackboard panel on core indicated.
- E. Aluminum Frames: Fabricated from not less than 0.062-inch- thick, extruded aluminum; standard size and shape.
 - 1. Aluminum Finish: Clear anodic finish.
- F. Joints: Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints, balanced around center of board, as acceptable to Architect.
- G. Chalktray/Markertray: Manufacturer's standard; continuous.
 - 1. Solid Type: Extruded aluminum with ribbed section and smoothly curved exposed ends.

2.3 MARKERBOARD PANELS

- A. Porcelain-Enamel Markerboard Panels: Balanced, high-pressure, factory-laminated markerboard assembly of three-ply construction, consisting of moisture-barrier backing, core material, and porcelain-enamel face sheet with low-gloss finish. Laminate panels under heat and pressure with manufacturer's standard, flexible waterproof adhesive.
 - 1. Face Sheet Thickness: 0.021 inch(25 gauge) uncoated base metal thickness.
 - 2. Particleboard Core: 7/16 inch thick; with 0.015-inch- thick, aluminum sheet backing.
 - 3. Laminating Adhesive: Manufacturer's standard moisture-resistant thermoplastic type.

2.4 TACKBOARD PANELS

- A. Tackboard Panels:
 - 1. Facing: 1/8-inch-thick, natural-cork.
 - 2. Core: 1/4-inch-thick hardboard.

2.5 MATERIALS

- A. Porcelain-Enamel Face Sheet: PEI-1002, with face sheet manufacturer's standard two- or three-coat process.
 - 1. Provide magnetic porcelain-enamel.
- B. Natural-Cork Sheet: Seamless, single-layer, compressed fine-grain cork sheet; bulletin board quality; face sanded for natural finish with surface-burning characteristics indicated.
- C. Hardboard: ANSI A135.4, tempered.
- D. Particleboard: ANSI A208.1, Grade M-1, and as follows:
 - 1. Composite Wood Products: Products shall be made without urea formaldehyde.
 - Low-Emitting Composite Wood: Provide materials/products that have low formaldehyde emissions that meet the California Air Resources Board (CARB) ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or no added formaldehyde resins.
- E. Extruded Aluminum: ASTM B 221, Alloy 6063.
- F. Adhesives for Field Application: Mildew-resistant, nonstaining adhesive for use with specific type of panels, sheets, or assemblies; and for substrate application; as recommended in writing by visual display unit manufacturer.
 - Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- G. Primer/Sealer: Mildew-resistant primer/sealer complying with requirements in Section 099123 "Interior Painting" and recommended in writing by visual display unit manufacturer for intended substrate.

2.6 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, AA-M12C22A31, Class II, 0.010 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motorized, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display units.
- D. Examine walls and partitions for suitable framing depth where sliding visual display units will be installed.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances, such as dirt, mold, and mildew, that could impair the performance of and affect the smooth, finished surfaces of visual display boards.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display units and wall surfaces.
- D. Prime wall surfaces indicated to receive visual display units and and as recommended in writing by primer/sealer manufacturer and visual display unit manufacturer.
- E. Prepare recesses for sliding visual display units as required by type and size of unit.

3.3 INSTALLATION

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.
- B. Factory-Fabricated Visual Display Board Assemblies: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display board assemblies with fasteners at not more than 16 inches o.c. Secure tops and bottoms of boards to walls.
- C. Visual Display Board Assembly Mounting Heights: Install visual display units at mounting heights indicated on Drawings.

3.4 CLEANING AND PROTECTION

- A. Clean visual display units according to manufacturer's written instructions. Attach one removable cleaning instructions label to visual display unit in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display units after installation and cleaning.

END OF SECTION

SECTION 104413 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-protection cabinets for the following:
 - a. Portable fire extinguishers.
- B. Related Requirements:
 - 1. Section 104416 "Fire Extinguishers."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
- B. Product Schedule: For fire-protection cabinets. Indicate whether recessed, semirecessed, or surface mounted. Coordinate final fire-protection cabinet schedule with fire-extinguisher schedule to ensure proper fit and function. Use same designations indicated on Drawings.
- 1.4 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.5 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.

2.2 FIRE-PROTECTION CABINET

- A. Cabinet Type: Suitable for fire extinguisher.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide products indicated in this Section, or comparable product by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Larsens Manufacturing Company.
 - d. Potter Roemer LLC.
- B. Cabinet Construction: Nonrated, and fire rated where required to match Wall Type.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.
- C. Cabinet Material: Cold-rolled steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Surface-Mounted Cabinet, FEC-3: Cabinet box fully exposed and mounted directly on wall with no trim.
 - 1. Basis-of-Design: Larsen's FS 2409-SM.
- E. Cabinet Trim Material: Steel sheet Same material and finish as door.
- F. Door Material: Steel sheet.
- G. Door Style: Fully glazed panel with frame.
- H. Door Glazing: Acrylic sheet.
 - 1. Acrylic Sheet Color: Clear transparent acrylic sheet.
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide recessed door pull and friction latch.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated.
 - a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

- 1) Location: Applied to cabinet door.
- 2) Application Process: Decals.
- 3) Lettering Color: Red.
- 4) Orientation: Vertical.

K. Materials:

- 1. Cold-Rolled Steel: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
 - a. Finish: Baked enamel or powder coat.
 - b. Color: As selected by Architect from full range of industry colors and color densities.
- 2. Transparent Acrylic Sheet: ASTM D 4802, Category A-1 (cell-cast sheet), manufacturer's standard thickness for specified door style, with Finish 1 (smooth or polished).

2.3 FABRICATION

- A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 - 1. Weld joints and grind smooth.
 - 2. Provide factory-drilled mounting holes.
 - 3. Prepare doors and frames to receive locks.
 - 4. Install door locks at factory.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.
 - 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 - 2. Miter and weld perimeter door frames.

2.4 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls and partitions for suitable framing depth and blocking where cabinets will be installed.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.
 - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
 - 2. Provide inside latch and lock for break-glass panels.
 - 3. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Identification: Apply decals at locations indicated.

3.3 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.
- C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.
- E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 104416 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes portable, hand-carried fire extinguishers, and mounting brackets for fire extinguishers.
- B. Related Requirements:
 - 1. Section 104413 "Fire Protection Cabinets."

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function.
- 1.4 INFORMATIONAL SUBMITTALS
 - A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.
- 1.6 COORDINATION
 - A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:

- a. Failure of hydrostatic test according to NFPA 10.
- b. Faulty operation of valves or release levers.
- 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
 - 1. Provide fire extinguishers approved, listed, and labeled by FM Global.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Fire Extinguishers: Commercial-grade, of type, size, and capacity for each fire-protection cabinet , and mounting bracket indicated.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Fire Equipment, Inc.
 - b. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - c. Kidde Residential and Commercial Division; Subsidiary of Kidde plc.
 - d. Larsens Manufacturing Company.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Stainless steel.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.
- B. Multipurpose Dry-Chemical Type: UL-rated 4-A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets, FEC-0: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Location: Where indicated on Drawings.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 104416

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SECTION 122413 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Manually operated roller shades with single rollers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
- D. Product Schedule: For roller shades. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.
- B. Manufacturer's warranties.
- 1.5 QUALITY ASSURANCE
 - A. Installer Qualifications: Fabricator of products.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.7 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.8 WARRANTY

- A. Limited Lifetime Warranty: Provide manufacturer's warranty against original defects in materials and workmanship for the life of the shade not to exceed 25 years from date of substantial completion.
- B. Motor and Controls Warranty: Provide manufacturer's warranty for motor and control system for five years from date of substantial completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide products by Insolroll, contact InPro/Becky Parnell, 720-256-3395, or comparable product by one of the following:
 - 1. Draper Inc.
 - 2. Hunter Douglas Contract.
 - 3. MechoShade Systems, Inc.
- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Stainless steel.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Clip, jamb mount.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.

- a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.
- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 - 1. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Shadebands:
 - 1. Shadeband Material: Light-filtering fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
- F. Installation Accessories:
 - 1. Front Fascia: Aluminum extrusion that conceals front and underside of roller and operating mechanism and attaches to roller endcaps without exposed fasteners.
 - a. Shape: L-shaped.
 - 2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: Woven PVC-coated fiberglass and PVC-coated polyester.
 - 3. Weave: 2x2 Basketweave.
 - 4. Openness Factor: 3 percent.
 - 5. Color: As indicated on Drawings.

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

- 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch . Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch , plus or minus 1/8 inch .
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, locations of connections to building electrical system, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
- B. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION
SECTION 123661.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Solid surface countertops.
 - 2. Solid surface backsplashes.
 - 3. Solid surface apron fronts.
 - 4. Solid surface window stools and aprons.
- B. Related Requirements:
 - 1. Division 22 "Plumbing Fixtures" for non-integral sinks and plumbing fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials .
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
 - 1. Show locations and details of joints.
 - 2. Show direction of directional pattern, if any.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses, and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops similar to that required for this Project, and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous-filled plastic resin complying with ICPA SS-1.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or approved substitution by one of the following:
 - a. Avonite Surfaces.
 - b. Caesarstone; contact Lynn Vechell, 303-521-2606.
 - c. E. I. du Pont de Nemours and Company (Corian).
 - d. Formica Corporation.
 - e. Wilsonart International Holdings, Inc.
 - 2. Type: Provide Standard type unless Special Purpose type is indicated.
 - 3. Colors and Patterns: Match Architect's samples.

2.2 COUNTERTOP FABRICATION

- A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's "Architectural Woodwork Standards."
 - 1. Grade: Custom.
- B. Countertops: Provide thickness and edge profile as indicated on Drawings, solid surface material.
- C. Backsplashes: Provide thickness as indicated on Drawings, solid surface material.
- D. Window Stools and Aprons: Provide thickness as indicated on Drawings, solid surface material.
- E. Fabricate with shop-applied edges unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
- F. Joints: Fabricate countertops in sections for joining in field.

- 1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
- 2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit.
- G. Cutouts and Holes:
 - 1. Undercounter Plumbing Fixtures (where indicated): Make cutouts for fixtures in shop using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
 - a. Provide vertical edges, slightly eased at juncture of cutout edges with top and bottom surfaces of countertop and projecting 3/16 inch into fixture opening.
 - 2. Counter-Mounted Plumbing Fixtures (where indicated): Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
 - 3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers, and similar items.
 - 4. Counter-Mounted Cooktops: Prepare countertops in shop for field cutting openings for cooktops. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.

2.3 INSTALLATION MATERIALS

- A. Adhesive: Product recommended by solid surface material manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - Low-Emitting Adhesives and Sealants: Provide products, applied on-site within the weatherproofing system, that comply with South Coast Air Quality Management District (SCAQMD) Rule 1168 for VOC content, and comply with the California Department of Public Health (CDPH) Standard Method v1.1-2010, using the applicable exposure scenario.
- B. Sealant for Countertops: Comply with applicable requirements in Section 079200 "Joint Sealants."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet, 1/4 inch maximum. Do not exceed 1/64-inch difference between planes of adjacent units.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
- C. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.
 - 1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
 - 2. Clamp units to temporary bracing, supports, or each other to ensure that countertops are properly aligned and joints are of specified width.
- D. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
- E. Install aprons to backing and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears. Fasten by screwing through backing. Predrill holes for screws as recommended by manufacturer.
- F. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
- G. Apply sealant to gaps at walls; comply with Section 079200 "Joint Sealants."

END OF SECTION

SECTION 210500 - COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. All drawings associated with the entire project, including general provisions of the Contract, including The General Conditions of the Contract for Construction, General and Supplementary Conditions and Division-1 Conditions specification sections shall apply to the Division 21, 22, and 23 specifications and drawings. The Contractor shall be responsible for reviewing and becoming familiar with the aforementioned and all other Contract Documents associated with the project.
- B. Related Sections: Refer to all sections in Division 21, 22, and 23. Refer to Division 26 specification sections and Division 26 drawings.
- C. Where contradictions occur between this section and Division 1, the more stringent requirement shall apply.
- D. Contractor shall be defined as any and all entities involved with the construction of the project.

1.2 SUMMARY:

- A. This Section specifies the basic requirements for fire protection installations and includes requirements common to more than one section of Divisions 21, 22, and 23. It expands and supplements the requirements specified in Division 1.
- 1.3 FIRE PROTECTION INSTALLATIONS:
 - A. The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the mechanical work and its interface with all other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.
 - B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. Report any discrepancies to the Engineer and obtain written instructions before proceeding. Where any contradictions occur between the specifications and the drawings the more stringent requirement shall apply. The contractor shall include pricing for the more stringent and expensive requirements.
 - C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, Contractor shall take the necessary measurements and prepare the drawings.
 - D. The exact location for some items in this specification may not be shown on the drawings. The location of such items may be established by the Engineer during the progress of the work.
 - E. The contract documents indicate required size and points of terminations of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. It is not intended that drawings indicate necessary offsets. The contractor shall make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or costs to the Owner. All equipment shall be installed so access is maintained for serviceability.

- F. Before any work is installed, determine that pipe and equipment will properly fit the space; that required piping grades can be maintained and that piping can be run as intended without interferences between systems, structural elements or work of other trades.
- G. Verify all dimensions by field measurements.
- H. Coordinate installation in chases, slots and openings with all other building components to allow for proper mechanical installations.
- I. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- J. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- K. Install pipe and equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- L. Make allowance for expansion and contraction for all building components and piping systems that are subject to such.
- M. The ceiling space shall not be "layered". It is the contractor's responsibility to offset the system as required to allow installation within the identified ceiling cavity. The contractor shall include labor and material in the base bid to accommodate such offsets.
- N. In general, all "static" piping systems shall be routed as high as possible, i.e. fire protection systems. Keep all equipment in accessible areas such as corridors and coordinate with systems and equipment from other sections.
- O. The Contractor shall provide all labor and material necessary but not limited to the starting/stopping of all equipment, opening/closing of all valves, draining/refilling all systems and operating/verifying the operation of all systems controls as required to accomplish all work necessary to meet construction document requirements. Contractor shall submit records of such activities to engineer and include in the O & M manuals.

1.4 COORDINATION:

- A. Work out all installation conditions in advance of installation. The Contractor shall be responsible for coordination of all work, <u>in all areas</u>. The Contractor shall be responsible for providing all labor and material, including but not limited to all fittings, isolation valves, offsets, hangers, devices, etc., necessary to overcome congested conditions at no increase in contact sum. The Contractors base bid shall include any and all time and manpower necessary to develop such coordination efforts and shop drawings. Increases to contract sum or schedule shall not be considered for such effort.
- B. Provide proper documentation of equipment, product data and shop drawings to all entities involved in the project. Coordination shall include, but not be limited to the following:
 - 1. Fire Protection and Fire Alarm Contractor shall provide shop drawings to all other Contractors.
- C. Existing Conditions:

- 1. Carefully survey existing conditions prior to bidding work. In addition, Contractor shall complete a thorough ceiling cavity survey prior to developing drawings.
- 2. Contractor shall be responsible for showing all existing conditions on the shop drawings.
- 3. Provide proper coordination of mechanical work with existing conditions.
- 4. Report any issues or conflicts immediately to Engineer before commencing with work and prior to purchasing equipment and materials.

1.5 COORDINATION WITH OTHER DIVISIONS:

- A. General:
 - 1. Coordinate all work to conform to the progress of the work of other trades.
 - 2. Complete the entire installation as soon as the condition of the building will permit. No extras will be allowed for corrections of ill-timed work, when such corrections are required for proper installation of other work.
- B. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install systems within the cavity space allocation in the following order of priority:
 - 1. Equipment and required clearances
 - 2. Plumbing waste, cooling coil drain piping and roof drain mains and leaders.
 - 3. Ductwork mains
 - 4. Plumbing vent piping
 - 5. Medgas/lab gas systems
 - 6. Low pressure ductwork and air devices.
 - 7. Electrical and communication conduits, raceways and cabletray.
 - 8. Domestic hot and cold water
 - 9. Hydronic piping
 - 10. Fire sprinkler mains, branch piping and drops (locate as tight to structure as possible).
 - 11. DDC control wiring and other low voltage systems.
 - 12. Fire alarm systems.
- C. Chases, Inserts and Openings:
 - 1. Provide measurements, drawings and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
 - 2. Check sizes and locations of openings provided. Including the access panels for equipment in hard lid ceilings and wall cavities.
 - 3. Any cutting and patching made necessary by failure to provide measurements, drawings and layouts at the proper time shall be done at no additional cost in contract sum.
- D. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.
- E. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Refer to Division 1 and Division 23.
- G. Modifications required as a result of failure to resolve interferences, provide correct shop drawings or call attentions to changes required in other work as result of modifications shall be paid for by responsible Contractor/Subcontractor.

H. Coordination with Electrical Work: Refer to Division 1 and 26.

1.6 DESIGN WORK REQUIRED BY CONTRACTOR:

- A. The construction of this project requires the Contractor to include the detailing and design of several systems and/or subsystems. All such design work associated with the development of shop drawings shall be the complete responsibility of the Contractor.
- B. The Contractor shall take the full responsibility to develop and complete routing strategies which will allow fully coordinated system to be installed in a fully functional manner. The Engineers contract drawings shall be for system design intent and general configurations.
- C. Systems or subsystems which require design responsibility by the contractor include but are not limited to:
 - 1. Final coordinated distribution of fire protection and other systems within the ceiling cavity.
 - 2. Any system not fully detailed
 - 3. Equipment supports, hangers, anchors and seismic systems not fully detailed nor specified in these documents, or catalogued by the manufacturer.
 - **4.** Seismic restraint systems
- D. Design Limitations:
 - 1. The Contractor shall not modify the Engineers design intent in any way.
 - 2. The Contractor shall not change any pipe size or equipment size without prior written approval from the Engineer.
 - **3.** The Contractor shall conform to the NFPA and IFC when design and installing fire protection systems.

1.7 PROJECT CONDITIONS:

- A. The Contractor shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for existing conditions.
- B. Field verify all conditions prior to submitting bids.
- C. Report any damaged equipment or systems to the Owner prior to any work.
- D. Protect all work against theft, injury or damage from all causes until it has been tested and accepted.
- E. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the work which may show defect during one year from the final acceptance of all work, provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.
- F. The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections, system shutdowns and start-ups, flushing and filling both new and existing systems.
- G. Provide temporary ductwork and piping services, where required, to maintain existing areas operable.

- H. Coordinate all services shut-down with the Owner; provide temporary services. Coordinate any required disruptions with Owner, one week in advance.
- I. Minimize disruptions to operation of mechanical systems in occupied areas.

1.8 SAFETY:

- A. Refer to Division 1.
- 1.9 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS:
 - A. Refer to Division 1 and conform with the State and Owners requirements.
- 1.10 REQUIREMENTS OF REGULATORY AGENCIES:
 - A. Refer to Division 1.
 - B. Execute and inspect all work in accordance with all Underwriters, local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater requirement shall be followed. Follow recommendations of NFPA, EPA, and OSHA.
 - C. Comply with the local and state codes adopted by the Authorities Having Jurisdictions at the time of permit application, including referenced standards, amendments and policies as outlined and adopted by State Fire Marshal.
 - D. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
 - E. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
- 1.11 REQUIREMENTS OF LOCAL UTILITY COMPANIES:
 - A. Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required but not provided by Local Utility Company for the project.
 - B. Utility Connections:
 - 1. Coordinate connection of fire protection systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies and controlling agencies. Provide required connection for each service.
 - 2. The contract documents indicate the available information on existing utilities and services and on new services (if any) to be provided to the project by utility companies and agencies. Notify Engineer immediately if discrepancies are found.
 - 3. Coordinate mechanical utility interruptions one week in advance with the Owner and the Utility Company. Plan work so that duration of the interruption is kept to a minimum.
- 1.12 PERMITS AND FEES:
 - A. Refer to Division 1.

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- B. The Contractor shall pay all tap, development, meter, etc., fees required for connection to municipal and public utility facilities, unless directed otherwise by the General Contractor/Owner – IN WRITING.
- C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.
- 1.13 PROJECT SEISMIC REQUIREMENTS:
 - A. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
 - B. All systems shall be installed to meet NFPA and IBC Seismic requirements.
 - 1. Where any conflicts arise the more stringent requirements shall be applicable.
 - 2. The design of the seismic requirements shall be the full responsibility of the Contractor.

1.14 TEMPORARY FACILITIES:

- A. Light, Heat, Power, Etc.: Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.
- 1.15 PRODUCT OPTIONS AND SUBSTITUTIONS:
 - A. Refer to the Instructions to Bidders and Division 1.
 - B. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.
 - C. Bidders opting to bid or propose comparable products (either a product by a listed acceptable manufacturer in the respective specification section or a substitution request) are responsible for:
 - 1. Confirming the equipment they are bidding will fit in the space available, incorporating equipment's clearance requirements.
 - 2. Coordination of any variance from basis-of-design in weight, electrical requirements, other utility requirements, etc. with other trades.
 - 3. Inclusion in the bid of any applicable costs for changes in prime bidder's and their sub bidders' work required to accommodate the utilization of the comparable product.
 - 4. The contractor shall bear any and all responsibility including any changes to mechanical, plumbing, electrical, structural or architectural design. These changes shall be clearly identified and presented to the Design Team.

1.16 SUBMITTALS:

A. General

1. Refer to the Conditions of the Contract (General and Supplementary), Division 1.

- 2. Contractor shall provide a submittal schedule appropriate for the size and schedule of the project. Limit the number of large submittals being reviewed at one time and coordinate timing of sections that are dependent on each other.
- 3. The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
- 4. The front of each submittal package shall be identified with the specification section number, job name, Owner's project number, date, Prime Contractor and Sub-Contractor's names, addresses, and contact information, etc. Each Specification Section shall be submitted individually and submittal shall be tabbed for the equipment/materials/etc. within the section. Submittals that are not complete with the required information will not be reviewed and will be sent back to be corrected.
- 5. Submittals shall be provided electronically. All electronic submittals need to be complete with all design information and stamped for conformity by the contractor. Submittals will be reviewed, marked appropriately and returned by the same means received.
- 6. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)
 - c. Specification Section
 - d. Manufacturer and Model Number
- 7. Submittal schedule shall be provided for review within four (4) working weeks from award of contract to successful bidder or as required by Division 1.
- B. Basis of Design: The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the basis of design and provided for the establishment of size, capacity, grade and quality. If the contractor proposes alternates or substitutions in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.
- C. All equipment shall conform to the State and/or local Energy Conservation Standards.
- D. Contractor Review: Submittal of shop drawings, product data and samples will be accepted only when submitted by and stamped by the General Contractor. Each submittal shall be reviewed by the State Fire Marshal and Authority having Jurisdiction and stamped by the respective Fire Marshall prior to submittal to the Architect/Engineer. Any submittal not stamped or complete will be sent back. Data submitted from Subcontractors and material suppliers directly to the Engineer will not be processed unless prior written approval is obtained by the Contractor.
- E. Submittal Review Process: Before starting work, prepare and submit to the Architect/Engineer shop drawings and descriptive equipment data required for the project. Continue to submit in the stated format after each Architect/Engineer's action until a "No Exception Taken" or "Make Correction Noted" action is received. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the Operating and Maintenance Manual (O&M). Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer may summarize comments in letter format and return the entire set. Submittals shall be prepared per the SUBMITTAL CHECKLIST, at the end of this section.
- F. The Design Professional's review and appropriate action on all submittals and shop drawings is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include:

- 1. Accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes
- 2. Construction means or methods
- 3. Coordination of the work with other trades
- 4. Construction safety precautions
- G. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component.
- H. The Design Professional shall not be responsible for any deviations from the contract documents not brought specifically to the attention of the Design Professional in writing by the Contractor. This shall clearly identify the design and the specific element which vary from the Design. The Contractor shall be responsible for all remedy for lack of strict conformance associated with this criteria.
- I. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
- J. If more than two submittals (either for product data, shop drawings, record drawings, or test and balance reports) are made by the Contractor, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.
- K. The contractor shall cloud all changes made on submittals that are marked "Revise and Resubmit."
- L. Required Submittals: Provide submittals for each item of equipment specified or scheduled in the contract documents. See table at the end of this section.
- 1.17 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:
 - A. Product Listing:
 - 1. Prepare listing of major I equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect. A sample schedule is included at the end of this section to complete this requirement.
 - a. Provide all information requested.
 - b. Submit this listing as a part of the submittal requirement specified in Division 1, "PRODUCTS AND SUBSTITUTION."
 - 2. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.
 - 3. When two or more items of same material or equipment are required (pipe, valves, sprinklers, fittings, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), wire, steel bar stock, welding rods, fasteners, and similar items used in work, except as otherwise indicated.
 - a. Provide products which are compatible within systems and other connected items.
 - B. Schedule of Values

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- 1. Provide preliminary schedule of values with product data submittal, within three (3) weeks from award of contract to successful bidder. Provide according to the following descriptions:
 - a. Site Utilities
 - b. Fire Protection
 - 1) Equipment
 - 2) Piping rough in
 - 3) Piping finish
 - 4) Testing and training
- 2. Provide a final Schedule of Values at close-out of project including updated values based on actual installation.
- C. Product Data:
 - 1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
 - 2. Delete or mark-out portions of pre-printed data which are not applicable.
 - 3. Where operating ranges are shown, mark data to show portion of range required for project application.
 - 4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Piping and electrical connection sizes and locations.
 - f. Statements of compliance with the required standards and regulations.
 - g. Performance data.
 - h. Manufacturer's specifications.
- D. Shop Drawings:
 - 1. Shop Drawings are defined as sprinkler system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
 - 2. Prepare Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", unless otherwise noted.
 - a. Show clearance dimensions at critical locations.
 - b. Show dimensions of spaces required for operation and maintenance.
 - c. Show interfaces with other work, including structural support.
- E. Test Reports:
 - 1. Submit test reports which have been signed and dated by the accredited firm or testing agency performing the test.
 - 2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
 - 3. Submit test reports as required for O & M manuals.
- F. Operation and Maintenance Data: See separate paragraph of this specification section.

- G. Record Drawings: See separate paragraph of this specification section.
- 1.18 DELIVERY, STORAGE, AND HANDLING:
 - A. Refer to Division 1 Sections on Transportation and Handling and Storage and Protection.
 - B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged and protected to prevent damage or contamination during shipment, storage, and handling.
 - C. Check delivered equipment against contract documents and submittals.
 - D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage, dirt, dust, freezing, heat and moisture.
 - E. Coordinate deliveries of materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.
 - F. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.
 - G. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
 - H. Protect flanges, fittings and specialties from moisture and dirt by inside storage and enclosure, or be packaging with durable, waterproof wrapping.

1.19 DEMOLITION:

- A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
- B. During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, piping and related items either as shown on the demolition drawings as being removed, or as required for the work. At the completion of the remodeling work or when directed by the Architect, all items demolished shall be removed from the premises.
- C. The location of existing equipment, pipes, ductwork, etc., shown on the drawings has been taken from existing drawings and is, therefore, only as accurate as that information. All existing conditions shall be verified from field measurements with necessary adjustment being made to the drawing information.
- D. Hazardous Material: If suspected hazardous material, in any form, is discovered by this Contractor in the process of his work, he shall report such occurrence to the Owner immediately. The Owner will determine the action to be taken for the hazardous material removal, which is not a part of the work to be done under this Division.

1.20 CUTTING AND PATCHING:

A. This Article specifies the cutting and patching of mechanical equipment, components and materials to include removal and legal disposal of selected materials, components and

equipment. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.

- B. Refer to Division 1.
- C. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective or non-conforming installations.
- F. Perform cutting, fitting and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective work;
 - 3. Remove and replace work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed work as specified for testing;
 - 5. Install equipment and materials in existing structures;
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect /Engineer observation of concealed work.
- G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of piping, sprinklers, and other items made obsolete by the new work.
- H. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain an approved type of temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas. Temporary partitions must not impede access to building egress.
- J. Locate, identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover. Protect equipment and systems to remain.
- 1.21 ROUGH-IN:
 - A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.
 - C. Work through all coordination before rough-in begins.
- 1.22 ACCESSIBILITY:
 - A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final

location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.

- B. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, and other operating devices requiring adjustment or servicing. Refer to Division 1 for access door specification.
- C. The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.
- D. Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.
- E. Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed. In lieu of these doors, approved shop fabricated access doors with DuroDyne hinges may be used.
- F. Access doors in fire-rated walls and ceilings shall have equivalent U.L. label and fire rating.
- G. Final installed conditions shall accommodate accessibility and replacement of system components that regularly require service and replacement. This includes control devices, etc.. Such devices shall not be permanently obstructed by building systems such as piping, ductwork, insulation, drywall, etc.
- 1.23 CLEANING:
 - A. Refer to Division 1.
- 1.24 RECORD DOCUMENTS:
 - A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
 - B. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.
 - C. Mark Drawing Prints to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of devices, and similar units requiring periodic maintenance or repair; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and devices located and numbered, and with items requiring maintenance located; Change Orders; concealed control system devices. Changes to be noted on the drawings shall include final location of any piping relocated more than 1foot-0inches from where shown on the drawings.
 - D. Mark shop drawings to indicate approved substitutions; Change Orders; actual equipment and materials used.
 - E. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme:
 - 1. Red shall indicate new items, deviations and routing.
 - 2. Green shall indicate items removed or deleted.
 - 3. Blue shall be used for relevant notes and descriptions.

- F. At the completion of the project, obtain from the Architect a complete set of the Mechanical Contract Documents in a read-only electronic format (.pdf unless otherwise noted). This set will include all revisions officially documented through the Architect/Engineer. Using the above color scheme, transfer any undocumented revisions from the construction site record drawings to this complete set. Submit completed documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.
- G. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up .pdf format readable by Bluebeam is preferred.
- 1.25 OPERATION AND MAINTENANCE DATA:
 - A. Refer to Division 1.
 - B. No later than four (4) weeks prior to the completion of the project provide one complete set of Operating and Maintenance Manuals, or as specified in Sections of Division 1 (whichever is more stringent).
 - C. The testing report shall be submitted and received by the Engineer at least fifteen calendar days prior to the contractor's request for final observation time frame requirements. Include in the O & M Manual after review with "No Exceptions Taken" has been accomplished.
 - D. In addition to the information required **by Division 1** for Maintenance Data, include the following information:
 - 1. The job name and address and contractor's name and address shall be identified at the front of the electronic submittal.
 - 2. Description of equipment, function, normal operating characteristics and limitations, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 3. Manufacturer's printed operating procedures to include start-up, routine and normal operating instructions; shut-down, and emergency instructions; and summer and winter operating instructions. Provide any test reports and start-up documents.
 - 4. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 5. Servicing instructions, including Contractor reports.
 - 6. Manufacturer's service manuals for all equipment provided under this contract.
 - 7. Name, Address and Telephone numbers of the Sub-contractors and local company and party to be contacted for 24-hour service and maintenance for each item of equipment.
 - 8. Complete recommended spare parts list.
 - 9. System and Equipment Warranties.
 - 10. Copies of all test reports shall be included in the manuals.
 - 11. Provide manuals with dividers for major sections and special equipment. Mark the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
 - 12. Final schedule of values with all mechanical change order costs included and identified.
 - 13. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up PDF format readable by Bluebeam is preferred.
 - E. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, and final Schedule of Values with all change order costs included and identified is provided and the manual is reviewed by the Architect/Engineer.

1.26 PROJECT CLOSEOUT LIST:

- A. In addition to the requirements specified in Division 1, complete the requirements listed below.
- B. The Contractor shall be responsible for the following Submittal Checklist either by performing and/or coordinating such items prior to applying for certification of substantial completion. Refer to individual specification sections for additional requirements. (Checklist is located at the end of this section.)
- 1.27 WARRANTIES:
 - A. Refer to the Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In any case the entire mechanical system shall be warranted no less than one year from the time of acceptance by the Owner.
 - B. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.28 CONSTRUCTION REQUIREMENTS:

- A. The contractor shall maintain and have available at the jobsite current information on the following at all times:
 - 1. Up to date record drawings.
 - 2. Submittals
 - 3. Site observation reports with current status of all action items.
 - 4. Test results; including recorded values, procedures, and other findings.
 - 5. Outage information.

1.29 SUBMITTAL CHECKLIST:

Spec Section	Item	Requirements							
		Submittals			Supplemental		Factory	Training	Extra
		Shop Drawings	Product Data	Include In O & M	Test ³	Report ³	Rep Super- Vision At Site	Req'd At Site	Material
210500	Common Work Results for Fire Suppression	х	х	x	х	х		х	х
211000	Water Based Fire Protection	х	Х	X	х	Х		Х	Х
Notes:	1 For Starters and Variable Frequency Drives 2 Requires Review & Approval of calibrated balance valves from T & B Contractor 3 See Specific Specification Section for Test & Certification Requirements								

END OF SECTION 210500

SECTION 211000 – WATER BASED FIRE PROTECTION

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. This Section specifies automatic sprinkler systems for buildings and structures. Materials and equipment specified in this Section include:
 - 1. Pipe, fittings, valves and specialties.
 - 2. Sprinklers and accessories.
 - B. Products furnished and installed include sprinkler head cabinet with spare sprinkler heads.
 - C. The work of this section includes engineering by the Contractor. The Contractor shall act as Engineer of record for all fire protection work.
 - D. The fire protection system work is an extension of the existing fire protection system. Provide all modifications to the existing system as required to complete the new work. Provide hydraulic calculations and shop drawings where required by the extent of the work or by the authority having jurisdiction.
- 1.2 DEFINITIONS:
 - A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).
 - B. Other definitions for fire protection systems are listed in NFPA Standards 13, 13R, 14, 20 and 24.
 - C. Working plans as used in this Section means those documents (including drawings and calculations) prepared pursuant to the requirements contained in NFPA 13 and 14 for obtaining approval of the authority having jurisdiction.

1.3 SYSTEM DESCRIPTION:

- A. Provide a complete fire sprinkler system for the entire building (including, but not limited to, electrical rooms, mechanical penthouses and accessible sections of air handling units,) except designated areas as shown on the drawings which will not require fire sprinkler coverage and will be specifically noted with "No A/S"
- B. Fire protection system is a "wet-pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

1.4 PROJECT SEISMIC REQUIREMENTS:

- A. All fire protection systems shall be installed to meet NFPA requirements. Refer to structural drawings for seismic design requirements. Provide seismic bracing as required by NFPA.
 - 1. Where any conflicts arise the more stringent requirements shall be applicable.

1.5 SUBMITTALS:

- A. Product data for each type sprinkler head, valve, piping and piping specialty, fire protection specialty, fire department connection and any equipment installed in accordance with the Contract Documents. Index per specification chapter and item number.
- B. Shop drawings prepared in accordance with NFPA 13 identified as "working plans," including detailed riser schematics indicating pipe sizes and lengths; and hydraulic calculations, which have been approved by the authority having jurisdiction. Do not proceed with the installation of the work until Authority having Jurisdiction has approved the shop drawings and the the Architect/Engineer review of shop drawings is received.
- C. Contractor shall stamp shop drawings indicating compliance with applicable codes and contract drawings. Contractor shall stamp drawing "Approved for Construction."
- D. If more than two submittals (either for shop drawings or for record drawings) are made by the contractor, the Owner reserves the right to charge the contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the contractor.
- E. Maintenance data for each type sprinkler head, valve, piping specialty, fire protection specialty, fire department connection and hose valve specified, for inclusion in operating and maintenance manual specified in Division 1 and Division-21 Section "Common Work Results for Fire Protection".
- F. Welder's qualification certificate.
- G. Test reports and certificates including "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Materials and Test Certificate for Underground Piping" as described in NFPA 13.
- H. Provide hydraulic calculations and drawings stamped by a Registered Engineer licensed in the State where the project is located and familiar with this type of installation and with previous similar experience (practicing in the Fire Protection field) certifying that the fire sprinkler system has been designed and hydraulically calculated in compliance with NFPA and governing codes. NICET stamps are not acceptable.
- I. Fire sprinkler piping design drawings shall show all ductwork, air devices, lighting and electrical panels.
- J. Shop drawings and hydraulic calculations shall be stamped and signed by the local fire prevention authority prior to submitting shop drawings to the Architect/Engineer.
- 1.6 HYDRAULIC DESIGN:
 - A. The Fire Sprinkler System shall be hydraulically calculated by the Contractor. Pipe schedule method is acceptable only as allowed in NFPA 13 and local Fire Marshal.
 - B. The wet pipe fire sprinkler system for the building shall be hydraulically calculated to comply with NFPA-13 and the following criteria:
 - 1. Light hazard occupancy for areas unless noted otherwise
 - 2. Ordinary hazard occupancy Group 1 for the following and per NFPA
 - a. Loading dock

- b. Commercial kitchens/Food preparation areas
- c. Storage rooms (Storage below 8 ft high)
- d. Mechanical equipment rooms
- e. Electrical equipment rooms
- f. Telecomm/Technology equipment rooms
- g. Parking Garages
- h. Theaters and auditoriums
- i. Laundries
- j. Library stack areas
- k. Radiology exam and treatment rooms, including control and equipment room
- I. Custodial closets.
- 3. Ordinary Hazard Group 2 for the following:
 - a. Boiler rooms
 - b. Generator rooms
 - c. Laboratories
 - d. Repair shop areas
 - e. Flammable storage rooms
 - f. Medical gas storage rooms
 - g. Stages
 - h. Electrical switchgear rooms
 - i. Wood shops
 - j. Machine shops/Metal shops
 - k. Elevator machine rooms
 - I. Storage rooms
- 4. Hose allowance shall comply with NFPA-13.
- C. The final fire protection system demand shall be a minimum of 10 PSI below the water supply curve.
- D. Velocities in pipes shall be shown on hydraulic calculations. Velocities in overhead piping shall not exceed 32 feet per second. Velocities in underground piping shall not exceed 16 feet per second per NFPA.
- E. Allow 10 feet of loss for electric water flow switches and note on hydraulic calculations.
- F. The Fire Protection Contractor shall provide as many sets of hydraulic calculations as necessary, performed and submitted to prove that the most remote and demanding areas are calculated.
- G. Design information shall be permanently affixed to the main riser as described in NFPA-13.
- H. Verify available static and residual pressures with Owner and A/E prior to bid based upon recent flow test.
- I. The Fire Protection Contractor shall be responsible for water flow data from the appropriate water department. A copy of the water flow test data from the water department shall accompany the hydraulic calculations before hydraulically calculating equipment fire sprinkler system.
- J. The pipe and valve sizes indicated on the drawings and details are minimum sizes to be used regardless of sizes allowed by hydraulic calculations.

- K. If flexible sprinkler pipe heads are used increased pressure drop shall be included in hydraulic calculations.
- L. Atriums, as defined by the International Building Code, shall be designed as a separate zone for activation of the smoke control system.

1.7 QUALITY ASSURANCE:

- A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by qualified installer. The contractor shall be licensed for the design and installation for the specific type of system in the jurisdiction where the work is to be performed and the State Fire Marshal. Upon request, submit evidence of such qualifications to the Engineer. Refer to Division-1 Section: "Definitions and Standards" for definitions for "Installers."
- B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS D10.9, Specifications of Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3."
- C. Regulatory Requirements: Comply with the requirements of the following codes:
 - 1. NFPA 13 Standard for the installation of Sprinkler System, including applicable seismic requirements.
 - 2. NFPA 13R Standard for the Installation of Sprinkler Systems in residential occupancies up to four stories.
 - 3. NFPA 14 Standard for the Installation of Standpipe and Hose Systems.
 - 4. NFPA 24 Installation of Private Fire Service Mains and their applications.
 - 5. NFPA 1961 Standard for Fire Hose.
 - 6. NFPA 1963 Screw Threads and Gaskets for Fire Hose Connections.
 - 7. UL and FM Compliance: All fire protection system materials and components shall be Underwriter's Laboratories and Factory Mutual listed as well as labeled for the application anticipated.
 - 8. National Electrical Code (NEC).
 - 9. International Building Codes, including applicable seismic requirements.
 - 10. Requirements of the local Building Department and Fire Department.
- D. Reference and standards listed are minimum requirements. Where more stringent requirements are specified or noted on the drawings, those shall be applicable.

1.8 SEQUENCING AND SCHEDULING:

- A. Schedule rough-in installations with installations of other building components.
- B. Minimum time frame for notice of inspections, tests and meetings is five (5) days and list the persons to be notified.
- 1.9 EXTRA STOCK:
 - A. Heads: For each style and temperature range (and length for dry heads) required, furnish additional sprinkler heads per NFPA-13.
 - 1. Obtain receipt from Owner that extra stock has been received.
 - B. Wrenches: Furnish 2 wrenches for each type and size of valve connection and fire hose coupling.

PART 2 - PRODUCTS

2.1 MATERIALS AND PRODUCTS:

- A. General: Provide piping materials and factory-fabricated piping products of sizes, types, pressure ratings, temperature ratings, and capacities as indicated. Where not indicated, provide proper selection as determined by Installer to comply with installation requirements. Provide sizes and types matching piping and equipment connections; provide fittings of materials which match pipe materials used in fire protection systems.
- B. All equipment used on this project shall be new and UL listed unless noted or specified otherwise.

2.2 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide fire protection system products from one of the following:
 - 1. Gate Valves:
 - a. Nibco
 - b. Kennedy Valve
 - c. Mueller
 - d. Stockham
 - e. Grinnell
 - f. Milwaukee
 - 2. Swing Check Valves:
 - a. Central
 - b. Mueller
 - c. Kennedy Valve
 - d. Star Sprinkler Corp.
 - e. Viking
 - f. Victaulic
 - g. Globe
 - h. Potter Roemer
 - 3. Butterfly and Ball Valves:
 - a. Grinnell
 - b. Mueller
 - c. Victaulic
 - d. Milwaukee
 - e. Kennedy
 - 4. Grooved Mechanical Couplings:
 - a. Gruvlok
 - b. Victaulic Company of America
 - c. Central Sprink, Inc.
 - 5. Fire Protection Specialty Valves
 - a. Reliable Automatic Sprinkler Co., Inc.

- b. Star Sprinkler Corporation
- c. Viking Corporation
- d. Central
- e. Globe
- f. Grinnell/Gem
- 6. Sprinkler Heads:
 - a. Automatic Sprinkler Corp. of America.
 - b. Tyco.
 - c. ITT Grinnell
 - d. Reliable Automatic Sprinkler Co., Inc.
 - e. Star Sprinkler Corp.
 - f. Viking Corp.
 - g. Globe
- 7. Fire Protection Specialties:
 - a. Croker-Standard Div.,; Fire-End & Croker Corp.
 - b. Elkhart Brass Mfg. Co., Inc.
 - c. Grinnell Fire Protection Systems Co., Inc.
 - d. Grunau Sprinkler Mfgr. Co., Inc.
 - e. Potter Roemer, Inc.
- 8. Inspector's Test and Drain Module
 - a. Victaulic
 - b. A.G.F.
 - c. Grinnell/Gem

2.3 BASIC IDENTIFICATION:

- A. General: Provide identification complying with NFPA in accordance with the following listing:
 - 1. Fire Protection Piping: Pipe markers.
 - 2. Fire Protection Valves: Valve tags.
 - 3. Fire Protection Signs: Provide the following signs Per NFPA and AJH:
 - a. At each sprinkler valve, sign indicating what portion of system valve controls.
 - b. At each outside alarm device, sign indicating what authority to call if device is activated.
 - c. At door to each sprinkler control valves or at ceiling access points, sign reading "FIRE CONTROL".
 - d. At each drain or test, sign indicating its purpose.
- B. Attach to the riser a metal sign indicating the name, address and telephone number of the fire protection contractor. Also indicate the date of installation and hydraulic information per NFPA.
- 2.4 BASIC PIPING SPECIALTIES:
 - A. General: Provide piping specialties complying with Section 210500, in accordance with the following listing:
 - 1. Pipe escutcheons.
 - 2. Drip pans.

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- 3. Pipe sleeves.
- 4. Sleeve seals.
- 5. Fire Barrier Penetration Seals.

2.5 BASIC SUPPORTS AND ANCHORS:

- A. General: Provide supports and anchors complying with NFPA in accordance with the following listing:
 - 1. Hangers (which are acceptable for project) and hanger spacing shall be in accordance with NFPA-13.
- 2.6 PIPE AND TUBING MATERIALS (INSIDE BUILDING):
 - A. General: Refer to Part 3 Article "Pipe Applications" for identification of systems where the below specified pipe and fitting materials are used.
 - B. Steel Pipe: ASTM A 53, A795 or A135, Schedule 40 or Schedule 10, U.S. manufacture, black steel pipe, with antimicrobial coating, plain ends.
 - C. Bull Moose "Eddy-Thread" & "Eddy Flow", Wheatland "Mega-Thread" & "Mega-Flow", Allied Tube and Conduit Corporation "Super Flo" are acceptable to Schedule 40 pipe. Installation shall be per manufacturer's recommendations.
 - D. Schedule 5 pipe shall not be allowed.
 - E. The Corrosion Resistance Ratio of the pipe shall be 1.00 or greater. Documentation shall be presented with product submittal.
 - F. Schedule 10 pipe shall only be allowed for pipe sizes 2-1/2inches and larger.
 - G. Provide galvanized, schedule 40, piping system for drain risers.
- 2.7 FITTINGS (INSIDE BUILDING):
 - A. Cast-Iron Threaded fittings: ANSI B16.4, Class 125 standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1.
 - B. Malleable-Iron Threaded Fittings: ANSI B16.3, Class 300, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1. Install steel pipe with threaded joints and fittings for 2inches and smaller and where shown on drawings.
 - C. Steel Fittings: ASTM A234, seamless or welded, for welded joints.
 - D. Grooved Mechanical Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47 Grade 32510 malleable iron; or ASTM A53, Type F or Types E or S.
 - E. Grooved Mechanical Couplings: Consist of ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure roll- grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service.
 - F. Grooved Mechanical Fittings and Couplings for the entire fire protection system shall be of the same manufacturer as submitted in shop drawing equipment review.

- G. Cast-Iron Threaded Flanges: ANSI B16.1, Class 250; raised ground face, bolt spot faced.
- H. Cast Bronze Flanges: ANSI B16.24, Class 300; raised ground face, bolt holes spot faced.
- I. Plain end, hooker type, or push-on fittings or couplings shall not be allowed.
- J. Bushings and reducing couplings shall not be allowed.
- K. UL listed and Factory Mutual approved segmentally welded fittings are acceptable. Friction loss and flow data shall accompany hydraulic calculations.
- 2.8 JOINING MATERIALS:
 - A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.
 - B. Gasket Materials: Thickness, materials and type suitable for fluid or gas to be handled, and design temperatures and pressures.
- 2.9 GENERAL DUTY VALVES:
 - A. Gate Valves 2 Inch and Smaller: Body and bonnet of cast bronze, 175 pound cold water working pressure non-shock, threaded ends, solid wedge, outside screw and yoke, rising stem, screw-in bonnet, and malleable iron handwheel. Valves shall be capable of being repacked under pressure, with valve wide open.
 - B. Gate Valves 2-1/2 Inch and Larger: Iron body; bronze mounted, 175 pound cold water working pressure non-shock. Valves shall have solid taper wedge; outside screw and yoke, rising stem; flanged bonnet, with body and bonnet conforming to ASTM A 126 Class B; replaceable bronze wedge facing rings; flanged ends; and a packing assembly consisting f a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open.
 - C. Butterfly Valves: 2-1/2inches to 12inches, grooved, ductile iron body and disc ASTM-536, disc EPDM coated, listed and approved minimum 175 psi service, actuator, self-contained supervisory switch, weatherproof approved for indoor or outdoor use.
 - D. Ball Valves: 1-1/2inches and smaller shall be threaded, forged brass construction, with Teflon seats and blow out proof stem. Ball shall be full port with chrome plated ball.
 - E. Ball Valves: 2inches to 3inches shall be listed to 300 p.s.i. with optional internal tamper switch. Body shall be ductile iron with corrosion resistant coating. Ball shall be 316 stainless steel, standard port design.
 - F. Swing Check Valves: MSS SP-71; Class 175, cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, with a bronze disc or cast iron disc with bronze disc ring, and flanged ends. Valve shall be capable of being refitted while the valve remains in the line.
 - G. Double Check Valve Assembly: Double check valve assembly shall be UL listed for fire protection service and USC-CCCF approved. Installation arrangement shall be per manufacturer's recommendations.

- H. Provide reduced pressure backflow preventer where required by authority having jurisdiction and/or water department having jurisdiction. See Part 2 Products under this Section for acceptable manufacturers and model number.
- I. Post Indicator: Provide PIV where required by NFPA and AHJ.
- 2.10 BASIC METERS AND GAUGES:
 - A. General: Provide meters and gauges complying with NFPA 13 appropriate for system pressures and applications.
 - 1. Pressure gauges, 0-250 psi range.

2.11 ALARM DEVICE AND FIRE PROTECTION SPECIALTIES:

- A. General: Provide fire protection specialties, UL-listed, in accordance with the listing. Provide sizes and types which mate and match piping and equipment connections.
- B. Water Flow Indicators: Vane type water flow detector, rated to 250 psig; designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 0.25 ampere 24 volts DC; complete with factory-set field-adjustable retard element to prevent false signals, tamper-proof cover which sends a signal when cover is removed, and with activation time retarding capability set at 30 seconds. The setting shall be verified through the inspectors test prior to final inspection.
- C. Supervisory Switches: Provide products recommended by manufacturer for use in service indicated. SPST, normally closed contacts, designed to signal valve in other than full open position.
- D. Pressure Switch: Indicating low pressure trouble in sprinkler system.
- E. Pressure switch: Indicating flow in sprinkler system.
- F. Low Air/Nitrogen Pressure Horn: Provide low air/nitrogen pressure horn as indicated.
- G. Electric Alarm Bell: UL, vibrating metal bell, [8] [10] inch, red enamel factory finish, suitable for outdoor use, listed and labeled per NFPA 70 marked for intended location and application.

2.12 AUTOMATIC SPRINKLERS:

- A. Sprinkler Heads: Fusible link or frangible bulb type, and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal ½ inch discharge orifice, for "ordinary" temperature range with a minimum temperature of 155 degrees F. Provide "intermediate" temperature heads in Electrical rooms, where required as noted in NFPA 13, and as required by the Authority having jurisdiction.
- B. Sprinkler Head Finishes: Provide heads with the following finishes:
 - 1. Upright, Pendent and Sidewall Styles: Factory brass, rough bronze finish for heads in unfinished spaces. Heads shall be stainless steel or wax coated where installed exposed to acids, chemicals, or other corrosive fumes.
 - 2. Concealed Style: Rough brass, adjustable, with painted white cover plate in finished spaces.
 - 3. Semi-Recessed Style: Bright chrome, with bright chrome escutcheon plate.
 - 4. See drawings for additional sprinkler type requirements.

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- C. Sprinkler Head Cabinet and Wrench: Finished steel cabinet, suitable for wall mounting, with hinged cover and space for spare sprinkler heads plus sprinkler head wrench. Provide amounts of each style per NFPA-13. Locate head cabinet on shop drawing submittal.
- D. Sprinkler Escutcheons:
 - 1. Ceiling Mounted: Chrome plated steel one piece flat of 2 piece with 1" adjustment
 - 2. Wall Mounted: Chrome plated steel one piece flat of 2 piece with 1" adjustment
- E. Plastic fire sprinkler escutcheons are not acceptable.
- F. Sprinkler Guards: UL 199, wire cage with fastening device for attaching to sprinkler head.
- 2.13 FLEXIBLE SPRINKLER HEAD CONNECTORS
 - A. General: UL listed, FM approved, braided corrugated annealed stainless steel hose with support brackets and inlet/outlet nipples
 - B. Length: no longer than 48"
 - C. Flexible Tube: 304 stainless steel
 - D. Braid: 304 stainless steel
 - E. Outlet Extension Nipple (Straight): Steel (ASTM A53 A) with yellow zinc plating.
 - F. Inlet Nipple: Steel (ASTM A53 A) with yellow zinc plating
 - G. Seal: EPDM
- 2.14 INSPECTOR'S TEST AND DRAIN ASSEMBLY:
 - A. Provide an alarm test module of a manufacturer listed in paragraph 2.2.
 - B. Comply with NFPA-14 for draining and testing of wet standpipe system.
 - C. Test and drain piping shall be routed to exterior. Location shall meet Owner's approval.

PART 3 - EXECUTION

- 3.1 EXAMINATION:
 - A. Examine rough-in for fire hose valves and cabinets to verify actual locations of piping connections prior to installing cabinets.
 - B. Examine walls for suitable conditions where cabinets are to be installed.
 - C. Do not proceed until unsatisfactory conditions have been corrected.
- 3.2 PIPE APPLICATIONS:
 - A. Wet Pipe Systems
 - 1. Pipe size 2" and smaller:

- a. Schedule 40 Black Steel with threaded joints and threaded fittings.
- b. Schedule 10 Black Steel with roll groove end fittings for steel pipe and grooved end couplings for steel pipe
- 2. Pipe Size 2-1/2" and larger:
 - a. Schedule 40 Black Steel with threaded joints and threaded fittings
 - b. Schedule 40 Black Steel with rolled groove ends, grooved fittings and grooved couplings for steel pipe.
 - c. Schedule 10 Black Steel with rolled groove ends, grooved fittings and grooved couplings for steel pipe.
- 3. Schedule 40 pipe acceptable manufacturers:
 - a. Bull Moose Eddy-Thread and Eddy-Flow
 - b. Wheatland Mega-Thread and Mega-Flow
 - c. Allied Tube
 - d. Conduit Corp Super-Flo
 - e. Installation shall be in accordance with manufacturers requirements.

3.3 PIPING INSTALLATIONS:

- A. Provide a minimum 5 feet-0 inches cover for all underground pipe installations. Install in accordance with AWWA C600.
- B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated. Drawings are diagrammatic in character and do not necessarily indicate every required offset, valve, fitting, etc.
 - 1. Deviations from approved "working plans" for sprinkler piping require written approval of the authority having jurisdiction. Written approval shall be on file with the Engineer prior to deviating from the approved "working plans."
- C. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.
- D. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Welded outlet branch pipe fittings are acceptable.
- E. Install unions in pipe 2 inch and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.
- F. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inch and larger connections.
- G. For welded pipe, all cutouts (coupons) shall be removed prior to installation.
- H. Hangers and Supports: Comply with the requirements of NFPA 13. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems. Provide protection from damage where subject to earthquake in accordance with NFPA 13.
- I. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.

- J. Install mechanical sleeve seal at pipe penetrations in basement and foundation walls.
- K. All piping penetrating fire walls to structure shall be sleeved and sealed per specification Section 23 05 09 "Mechanical Fire Stopping".
- L. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve.
- M. Install pressure gauge on the riser or feed main at or near each test connection. Provide gauge with a connection not less than ¼" and having a soft metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and where they will not be subject to freezing.
- N. The fire line entry valves shall have monitoring electrical switches, the wiring from which shall be carried to the fire annunciating panel.
- O. The fire protection contractor shall be responsible for the coordination of his installation with all other contractors. See Section 21 05 00 for prioritized components.
- P. Protect adjacent area where pipe cutting and threading takes place (e.g. floors, ceilings, walls, etc.).
- Q. There shall be no fire sprinkler piping in electrical rooms or IT/Technology rooms (with the exception of piping serving sprinklers directly in that room) no piping shall be installed over any electrical panels.
- R. Provide spring-loaded check valve at top of drain risers.
- S. Install pressure gauges on city and system sides of fire entry valve assembly per NFPA.
- T. Install hangers straight and true and piping parallel to building lines.
- U. Do not runt wet sprinkler piping through areas subject to freezing.
- 3.4 PIPE JOINT CONSTRUCTION:
 - A. Welded Joints: AWS D10.9, Level AR-3.
 - B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Join pipe, fittings, and valves as follows:
 - 1. Note the 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. Align threads at point of assembly.
 - 3. Apply appropriate tape or thread compound to the external pipe threads.
 - 4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
 - 5. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
 - C. Flanged Joints: 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 to appropriate torque specified by the bolt manufacturer.

- D. Mechanical Grooved Joints: Roll grooves on pipe ends dimensionally compatible with the couplings.
- E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.
- 3.5 VALVE INSTALLATIONS:
 - A. General: Install fire protection specialty valves, fittings and specialties in accordance with the manufacturer's written instructions, NFPA 13 and the authority having jurisdiction.
 - B. Gate Valves: Install electrically supervised-open indicating valves so located to control all sources of water supply except fire department and roof manifolds connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve.
- 3.6 SPRINKLER HEAD INSTALLATIONS:
 - A. Any sprinkler heads with any paint on them shall be replaced. The sprinkler system shall then be hydrostatically tested again at the contractor's expense.
 - B. Sprinkler heads shall be positioned so as to comply with NFPA-13 for any obstructions. This includes, but is not limited to, soffits, surface mounted lights, large ducts, and indirect lighting arrangements. The Fire Protection Contractor is responsible for identifying these obstructions and designing the system accordingly.
 - C. Run piping concealed above heated furred ceilings and in joists to minimize obstructions. Expose only heads.
 - D. Protect exposed sprinkler heads against mechanical injury with standard guards. Provide sprinkler head guards in all gyms, mechanical, electrical, IT/technology, or storage rooms, and gyms, as well as exposed pendant heads which are installed less than 8 feet-0 inches A.F.F.
 - E. Provide heads in "pocketed" areas caused by exposed duct, piping or beams per NFPA.
 - F. Sprinkler head deflector distance from face of finished ceiling per NFPA.
 - G. Sprinkler heads shall be located in the center of all 2 foot x 2 foot ceiling tiles and quarter points, along the center line lengthwise of 2 foot x 4 foot ceiling tiles.
 - H. Use proper tools to prevent damage during installations.
 - I. Install sprinkler piping in a manner such that mechanical equipment, ceiling tiles or lights can be accessed and easily removed. The sprinkler piping shall be installed to provide a minimum of 6 inches above the top of a finished ceiling where space allows.
 - J. Minimum fire sprinkler head temperature rating for sprinklers in electrical rooms shall be 212 degrees F. Keep sprinklers as far from transformers and/or panels as spacing allows.
- 3.7 INSTALLATION OF BASIC IDENTIFICATION:
 - A. Install fire protection signs and identification on piping in accordance with NFPA 13 and NFPA 14 requirements.
 - B. Install piping system labels to clearly identify all dry and preaction system piping. Follow requirements of Division 23 for label location and spacing.

3.8 INSTALLATION OF METERS AND GAUGES:

- A. Install meters and gauges in accordance with NFPA.
- 3.9 FIELD QUALITY CONTROL:
 - A. Flush, test and inspect sprinkler piping systems in accordance with NFPA 13, Standard for installation of sprinkler systems.
 - B. The fire sprinkler system shall not be connected to underground piping until the fire service main is tested and approved.
 - C. The Fire Protection Contractor shall conduct and bear the costs of all necessary tests of the fire protection work, furnish all labor, power and equipment. All piping shall be tested with water as required, the tests witnessed by the authority having jurisdiction.
 - D. Dry and preaction systems shall be both hydrostatically and pneumatically tested. Pneumatic test shall be in accordance with NFPA-13.
 - E. The fire protection piping shall be tested under a hydrostatic pressure of not less than pressure per NFPA, for a duration of not less than 2 hours.
 - F. Replace piping system components which do not pass the test procedures specified, and retest repaired portion of the system at Fire Protection Contractor's expense.
 - G. All piping tests (pneumatic and hydrostatic) shall be conducted prior to the application of any painting materials. This will prevent hidden leaks and/or repainting of repaired/altered piping.
- 3.10 FINAL INSPECTION AND TESTING:
 - A. The Contractor shall make arrangements with the Owner and Fire Marshal for final inspection and witnessing of the final acceptance tests. The Fire Protection Contractor, the Alarm System Contractor and the Owner will conduct the final inspection and witness the final acceptance test.
 - B. All tests and inspections required by the referenced Codes and Standards, and the Owner shall be performed by the Contractor.
 - C. The inspecting committee as referenced above will visit the job site to inspect the work and witness the final acceptance tests when they have been advised by the Contractor that the work is completed and ready for test. If the work is not complete or the test is unsatisfactory, the Contractor shall be responsible for the Consultant's extra time and expenses for re-inspection and witnessing the re-testing of the work. Such extra fees shall be deducted from payments by the Owner to the Contractor.
 - D. After the system has been inspected and tested, a certificate, "Contractor's Material and Test Certificate Sprinkler System - Water Spray System," shall be provided by the contractor and shall be signed by him or his representative, the Owner's representative and by a representative of the fire department. Sufficient copies shall be prepared to ensure the Engineer, Owner, all inspecting authorities and the contractor have a copy for their files. The Contractor shall prepare one (1) test report for each inspection performed whether successful or not.
 - E. The signing of the certificate by the Owner's representative shall in no way prejudice any claim against the contractor for faulty material, poor workmanship, or failure to comply with inspecting authority's requirements or local ordinances.

- F. Contractor shall provide at least five (5) working days' notice for all tests.
- G. All sprinkler supervisory initiating devices shall be functionally tested to verify proper operation.
- H. All supervisory functions of each initiating device shall be functionally tested.
- I. Receipt of all alarm and trouble signals, initiated during the course of the testing, shall be verified at the fire alarm control panel.
- 3.11 WORK BY OTHERS:
 - A. Wiring of all water flow switches and tamper switches on valves to central alarm panel are by Division 26. Coordinate requirements.
- 3.12 OPERATION AND MAINTENANCE MANUAL:
 - A. The Contractor shall provide the Owner with a loose-leaf manual containing:
 - 1. A detailed description of the systems.
 - 2. A detailed description of routine maintenance required or recommended or which would be provided under a maintenance contract including a maintenance schedule and detailed maintenance instructions for each type of device installed.
 - 3. One copy of NFPA-25.
 - 4. Manufacturers' data sheets and installation manuals/instructions for all equipment installed.
 - 5. A list of recommended spare parts.
 - 6. Service directory, listing the specific equipment items and where parts can be obtained, with name, address and telephone number.
 - 7. Set of the record drawings (PDF format).
 - 8. Hydraulic calculations
 - 9. Test certificates.
 - B. Refer to Division 1 and Section 21 05 00 for additional requirements.
 - C. Within 15 days of the completion of the work, six (6) copies of the manual shall be submitted for approval.

3.13 RECORD DRAWINGS:

- A. The Contractor shall provide and maintain on the site an up-to-date record set of approved shop drawing prints which shall be marked to show each and every change made to the sprinkler system from the original approved shop drawings. This shall not be construed as authorization to deviate from or make changes to the shop drawings approved by the Owner without written instruction from the Owner in each case. This set of drawings shall be used only as a record set.
- B. Upon completion of the work, the record set of prints shall be used to prepare complete, accurate final record drawings reflecting any and all changes and deviations made to the sprinkler system.
- C. The Owner, at his option and at the Contractor's expense, may require revised hydraulic calculations depending on the extent and nature of field changes.

- D. The Record Drawings and Hydraulic Calculations shall have the signed stamp of the individual who prepared the design certifying the Record Drawings and the Hydraulic Calculations accurately represent the completed fire protection system.
- E. Upon completion of the work, PDFs of the record drawings shall be submitted to the Architect/Engineer and Owner for review. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.

3.14 GUARANTEE PERIOD:

- A. Guarantee: The Contractor shall guarantee all materials and workmanship for a period of one year beginning with the date of final acceptance by the Owner. The Contractor shall be responsible during the design, installation, testing and guarantee periods for any damage caused by him (or his subcontractors) or by defects in his (or his subcontractors') work, materials, or equipment.
- B. Emergency Service: During the installation and warranty period, the Contractor shall provide emergency repair service for the sprinkler system within four hours of a request by the Owner for such service. This service shall be provided on a 24 hour per day, seven days per week basis.

3.15 TRAINING:

A. The Contractor shall conduct two (2) training sessions of four (4) hours each to familiarize the building personnel with the features, operation and maintenance of the sprinkler systems. Training sessions shall be scheduled by the Owner at a time mutually agreeable to the Contractor and the Owner.

3.16 WATER DAMAGE:

A. The Fire Protection Contractor shall be responsible for any damage to the work of others, to building and property/ materials of others caused by leaks in automatic sprinkler equipment, unplugged or disconnected pipes or fittings, and shall pay for necessary replacement or repair of work or items so damaged during the installation, testing or guarantee periods of the automatic sprinkler work.

END OF SECTION 211000

SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All drawings associated with the entire project, including general provisions of the Contract, including The General Conditions of the Contract for Construction, General and Supplementary Conditions and Division-1 Conditions specification sections shall apply to the Division 21, 22, and 23 specifications and drawings. The Contractor shall be responsible for reviewing and becoming familiar with the aforementioned and all other Contract Documents associated with the project.
- B. Related Sections: Refer to all sections in Division 21, 22, and 23. Refer to Division 26 specification sections and Division 26 drawings.
- C. Where contradictions occur between this section and Division 1, the more stringent requirement shall apply.
- D. Contractor shall be defined as any and all entities involved with the construction of the project.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Equipment installation requirements common to equipment sections.

1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for rubber materials:
 - 1. EPDM: Ethylene-propylene-diene terpolymer rubber.
 - 2. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Comply with Division 1 and requirements specified herein.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
 - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
 - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
- 1.6 DELIVERY, STORAGE, AND HANDLING
 - A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- 1.7 PLUMBING INSTALLATIONS:
 - A. The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the plumbing work and its interface with all other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.
 - B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. Report any discrepancies to the Engineer and obtain written instructions before proceeding. Where any contradictions occur between the specifications and the drawings the more stringent requirement shall apply. The contractor shall include pricing for the more stringent and expensive requirements.
 - C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, Contractor shall take the necessary measurements and prepare the drawings.
 - D. The exact location for some items in this specification may not be shown on the drawings. The location of such items may be established by the Engineer during the progress of the work.
 - E. The contract documents indicate required size and points of terminations of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. It is not intended that drawings indicate necessary offsets. The contractor shall make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or costs to the Owner. All equipment shall be installed so access is maintained for serviceability.
- F. Before any work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained and that ductwork can be run as intended without interferences between systems, structural elements or work of other trades.
- G. Verify all dimensions by field measurements.
- H. Coordinate installation in chases, slots and openings with all other building components to allow for proper mechanical installations.
- I. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- J. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- K. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- L. Make allowance for expansion and contraction for all building components and piping systems that are subject to such.
- M. The ceiling space shall not be "layered". It is the contractor's responsibility to offset and install system as required to allow installation within the identified ceiling cavity. The contractor shall include labor and material in the base bid to accommodate such offsets.
- N. In general, all "static" piping systems shall be routed as high as possible, i.e. fire protection systems. Keep all equipment in accessible areas such as corridors and coordinate with systems and equipment from other sections.
- O. The Contractor shall provide all labor and material necessary but not limited to the starting/stopping of all plumbing equipment, opening/closing of all valves, draining/refilling all plumbing systems and operating/verifying the operation of all plumbing systems controls as required to accomplish all work necessary to meet construction document requirements. Contractor shall submit records of such activities to engineer and include in the O & M manuals.

1.8 COORDINATION

- A. Work out all installation conditions in advance of installation. The Contractor shall be responsible for coordination of all work, <u>in all areas</u>. The Contractor shall be responsible for providing all labor and material, including but not limited to all fittings, isolation valves, offsets, hangers, control devices, etc., necessary to overcome congested conditions at no increase in contact sum. The Contractors base bid shall include any and all time and manpower necessary to develop such coordination efforts. Increases to contract sum or schedule shall not be considered for such effort.
- B. Provide proper documentation of equipment, product data and shop drawings to all entities involved in the project. Coordination shall include, but not be limited to the following:
 - 1. Fire Protection and Fire Alarm Contractor shall provide shop drawings to all other Division 21 and 23 Contractors.
 - 2. Automatic Temperature Controls, Building Management and Testing, Adjusting and Balancing Contractors shall be provided with equipment product data and shop drawings

from other Division 21, 22, 23 and 26 Contractors and shall furnish the same information involving control devices to the appropriate Division 21, 22, and 23 Contractor.

- 3. Furnish building equipment (elevator, food service, medical, technology, etc) information to Div 21, 22, and 23 contractors.
- C. Coordination Drawings
 - 1. Coordination drawings shall be prepared by the Contractor for his utilization and are his responsibility to assure systems will be installed in a manner to allow all systems to function properly.
 - 2. Submit drawings for all areas, pay special attention to those places where clearances are limited, where space problems exist, for places where several elements of work (or combinations of mechanical and other work) must be located with precision in order to fit into available space, where sequencing is of importance to the efficient flow of work and as specified, and required.
 - 3. Coordination drawings are informational submittals. Submit coordination drawings to Engineer for information only to document proper coordination of all portions of work and that coordination issues have been identified and resolved prior to submitting to the Engineer and prior to commencing construction in each affected area. The review of the coordination drawings by the Engineer does not constitute a relief of responsibility of the Contractor or a change to the contract documents. The Contractor shall have sole responsibility in developing a fully coordinated and integrated ceiling cavity.
 - 4. The Contractor shall take the lead in coordinating and drawing Division 26 and other Division 21, 22, and 23 components such as fire protection, plumbing, piping, sheet metal, etc. Where appropriate, the Contractor shall include medical gas, conduit, cable trays, pneumatic tube and any other system which may occupy the ceiling cavity.
 - 5. Clearly indicate solutions to space problems. Identification of space problems without solutions is not acceptable. Only areas clearly identified will be reviewed.
 - 6. Prepare Coordination Drawings and other Shop Drawings at a suitable scale, showing the required dimensions. In addition to the mentioned areas and systems above, also submit the following:
 - a. All mechanical equipment rooms such as fan rooms, boiler rooms, fire protection system rooms, etc. (1/4"=1'-0" scale).
 - b. All building floor plans (1/8"=1'-0" scale). Include all shafts with clearances.
 - c. Air handling unit, etc. main duct connections and transitions in ceiling space and to shafts or horizontal ducts. (1/4"=1'-0").
 - d. Required access for all equipment requiring code or maintenance access.
 - e. All sections and elevations necessary for clarification.
 - f. Indicate all seismic restraint and support systems to be used for all mechanical equipment throughout the project.
 - g. Indicate duct and pipe elevations. Indicate clearances for installing and maintaining insulation.
 - h. Servicing and maintaining equipment, valve stem movement, and similar requirements.
 - i. Indicate movement and positioning of large equipment into the building during construction. Indicate pipe and duct size. Indicate equipment tags.
 - 7. CADD Drawings: Electronic mechanical AutoCAD drawings are available from the Engineer. Contact Engineer for further information in acquiring CADD drawings. The Engineers Construction documents cannot be used directly for coordination drawings. They are for information and initial coordination only.
- D. Existing Conditions

- 1. Carefully survey existing conditions prior to bidding work. In addition, Contractor shall complete a thorough ceiling cavity survey prior to developing coordination.
- 2. Contractor shall be responsible for showing all existing conditions on coordination drawings.
- 3. Provide proper coordination of mechanical work with existing conditions.
- 4. Report any issues or conflicts immediately to Engineer before commencing with work and prior to purchasing equipment and materials.

1.9 COORDINATION WITH OTHER DIVISIONS

- A. General:
 - 1. Coordinate all work to conform to the progress of the work of other trades.
 - 2. Complete the entire installation as soon as the condition of the building will permit. No extras will be allowed for corrections of ill-timed work, when such corrections are required for proper installation of other work.
- B. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electrical systems within the cavity space allocation in the following order of priority:
 - 1. Equipment and required clearances
 - 2. Plumbing waste, cooling coil drain piping and roof drain mains and leaders.
 - 3. Ductwork mains
 - 4. Plumbing vent piping
 - 5. Medgas/lab gas systems
 - 6. Low pressure ductwork and air devices.
 - 7. Electrical and communication conduits, raceways and cabletray.
 - 8. Domestic hot and cold water
 - 9. Hydronic piping
 - 10. Fire sprinkler mains, branch piping and drops (locate as tight to structure as possible).
 - 11. DDC control wiring and other low voltage systems.
 - 12. Fire alarm systems.
- C. Chases, Inserts and Openings:
 - 1. Provide measurements, drawings and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
 - 2. Check sizes and locations of openings provided. Including the access panels for equipment in hard lid ceilings and wall cavities.
 - 3. Any cutting and patching made necessary by failure to provide measurements, drawings and layouts at the proper time shall be done at no additional cost in contract sum.
- D. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.
- E. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Refer to Division 1 and Division 23.

- G. Modifications required as result of failure to resolve interferences, provide correct coordination drawings or call attentions to changes required in other work as result of modifications shall be paid for by responsible Contractor/Subcontractor.
- H. Coordination with Electrical Work: Refer to Division 1 and 26.

1.10 DESIGN WORK REQUIRED BY CONTRACTOR

- A. The construction of this project requires the Contractor to include the detailing and design of several systems and/or subsystems. All such design work associated with the development of the coordination drawings shall be the complete responsibility of the Contractor.
- B. The Contractor shall take the full responsibility to develop and complete routing strategies which will allow fully coordinated system to be installed in a fully functional manner. The Engineers contract drawings shall be for system design intent and general configurations.
- C. Systems or subsystems which require design responsibility by the contractor include but are not limited to:
 - 1. Final coordinated distribution of duct, hydronic, plumbing and other systems within the ceiling cavity.
 - 2. Any system not fully detailed
 - 3. Fire protection systems
 - 4. Equipment supports, hangers, anchors and seismic systems not fully detailed nor specified in these documents, or catalogued by the manufacturer.
 - 5. Temperature controls systems
 - 6. Seismic restraint systems
- D. Design Limitations:
 - 1. The Contractor shall not modify the Engineers design intent in any way.
 - 2. The Contractor shall not change any pipe size or equipment size without prior written approval from the Engineer.
 - 3. Back to back 90° fittings on piping system shall not be installed under any circumstance.
 - 4. Bull nosed tees on piping systems shall not be installed under any circumstance.

1.11 PROJECT CONDITIONS

- A. The Contractor shall be required to attend a mandatory pre-bid walk-thru and shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for existing conditions.
- B. Field verify all conditions prior to submitting bids.
- C. Report any damaged equipment or systems to the Owner prior to any work.
- D. Protect all mechanical and electrical work against theft, injury or damage from all causes until it has been tested and accepted.
- E. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the work which may show defect during one year from the final acceptance of all work, provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.

- F. The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections, system shutdowns and start-ups, flushing and filling both new and existing systems.
- G. Provide temporary ductwork and piping services, where required, to maintain existing areas operable.
- H. Coordinate all services shut-down with the Owner; provide temporary services. Coordinate any required disruptions with Owner, one week in advance.
- I. Minimize disruptions to operation of mechanical systems in occupied areas.

1.11 REQUIREMENTS OF REGULATORY AGENCIES

- A. Refer to Division 1.
- B. Execute and inspect all work in accordance with all Underwriters, local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater requirement shall be followed. Follow recommendations of NFPA, SMACNA, EPA, OSHA and ASHRAE.
- C. Comply with the local and state codes adopted by the Authorities Having Jurisdictions at the time of permit application, including referenced standards, amendments and policies.
 - 1. Refer to the project code declaration sheet.
- D. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
- E. The handling, removal and disposal of regulated refrigerants and other materials shall be in accordance with U.S. EPA, state and local regulations.
- F. The handling, removal and disposal of lead based paint and other lead containing materials shall comply with EPA, OSHA, and any other Federal, State or Local regulations.
- G. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

1.12 PERMITS AND FEES

- A. Refer to Division 1.
- B. The Contractor shall pay all tap, development, meter, etc., fees required for connection to municipal and public utility facilities, unless directed otherwise by the General Contractor/Owner IN WRITING.
- C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.

1.13 PROJECT SEISMIC REQUIREMENTS

- A. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
- B. All systems shall be installed to meet NFPA and IBC Seismic requirements.
 - 1. Where any conflicts arise the more stringent requirements shall be applicable.
 - 2. The design of the seismic requirements shall be the full responsibility of the Contractor.
- C. Refer to structural drawings for Seismic Design conditions

1.14 TEMPORARY FACILITIES

- A. Light, Heat, Power, Etc.: Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.
- B. Use of Permanent Building Equipment for Temporary Heating or Cooling: Permanent building equipment shall not be used without written permission from the Owner. If this equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, etc. Steam and hydronic systems shall be flushed and chemically treated. Ductwork and air moving equipment shall be cleaned to an "AS New" condition. All filters required for the construction period shall be equivalent to the filters required for the final installation. All filters shall be replaced at the time of substantial completion. The guarantee period of all equipment used shall not start until the equipment is turned over to the Owner for his use. A written record of maintenance, operation and servicing shall be turned over to the owner prior to final acceptance.

1.15 PRODUCT OPTIONS AND SUBSTITUTIONS

- A. Refer to the Instructions to Bidders and Division 1.
- B. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.
- C. Materials and equipment of equivalent quality shall be submitted for substitution prior to bidding. This may be done by submitting to the Architect/Engineer at least ten (10) working days prior to the bid date requesting prior review. This submittal shall include all data necessary for complete evaluation of the product.
 - 1. Substitutions shall be allowed <u>only</u> upon the written approval of the Architect/Engineer NO EXCEPTIONS.
 - 2. The Contractor shall be responsible for removal, replacement and remedy of any system or equipment which has been installed which does not meet the specifications and scheduled performance or which does not have prior approval.
- D. Bidders opting to bid or propose comparable products (either a product by a listed acceptable manufacturer in the respective specification section or a substitution request) are responsible for:

- 1. Confirming the equipment they are bidding will fit in the space available, incorporating equipment's clearance requirements.
- 2. Coordination of any variance from basis-of-design in weight, electrical requirements, other utility requirements, etc. with other trades.
- 3. Inclusion in the bid of any applicable costs for changes in prime bidder's and their sub bidders' work required to accommodate the utilization of the comparable product.
- 4. The contractor shall bear any and all responsibility including any changes to mechanical, plumbing, electrical, structural or architectural design. These changes shall be clearly identified and presented to the Design Team.

1.16 SUBMITTALS

- A. General
 - 1. Refer to the Conditions of the Contract (General and Supplementary), Division 1.
 - 2. Contractor shall provide a submittal schedule appropriate for the size and schedule of the project. Limit the number of large submittals being reviewed at one time and coordinate timing of sections that are dependent on each other.
 - 3. The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
 - 4. The front of each submittal package shall be identified with the specification section number, job name, Owner's project number, date, Prime Contractor and Sub-Contractor's names, addresses, and contact information, etc. Each Specification Section shall be submitted individually and submittal shall be tabbed for the equipment/materials/etc. within the section. Submittals that are not complete with the required information will not be reviewed and will be sent back to be corrected.
 - 5. Submittals shall be provided electronically. All electronic submittals need to be complete with all design information and stamped for conformity by the contractor. Submittals will be reviewed, marked appropriately and returned by the same means received.
 - 6. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)
 - c. Specification Section
 - d. Manufacturer and Model Number
 - 7. Submittal schedule shall be provided for review within four (4) working weeks from award of contract to successful bidder.
- B. Basis of Design: The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the basis of design and provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.
- C. All equipment shall conform to the State and/or local Energy Conservation Standards.
- D. Contractor Review: Submittal of shop drawings, product data and samples will be accepted only when submitted by and stamped by the General Contractor. Each submittal shall be reviewed by the contractor for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Any submittal not stamped or complete will be sent back. Data submitted from Subcontractors and material suppliers directly to the Engineer will not be processed unless prior written approval is obtained by the Contractor.

- E. Submittal Review Process: Before starting work, prepare and submit to the Architect/Engineer shop drawings and descriptive equipment data required for the project. Continue to submit in the stated format after each Architect/Engineer's action until a "No Exception Taken" or "Make Correction Noted" action is received. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the Operating and Maintenance Manual (O&M). Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer may summarize comments in letter format and return the entire set. Submittals shall be prepared per the MECHANICAL SUBMITTAL CHECKLIST, at the end of this section; supplemental requirements are listed in each Division 21, 22, and 23 Sections.
- F. The Design Professional's review and appropriate action on all submittals and shop drawings is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include:
 - 1. Accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes
 - 2. Construction means or methods
 - 3. Coordination of the work with other trades
 - 4. Construction safety precautions
- G. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component.
- H. The Design Professional shall not be responsible for any deviations from the contract documents not brought specifically to the attention of the Design Professional in writing by the Contractor. This shall clearly identify the design and the specific element which vary from the Design. The Contractor shall be responsible for all remedy for lack of strict conformance associated with this criteria.
- I. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
- J. If more than two submittals (either for product data, shop drawings, record drawings, or test and balance reports) are made by the Contractor, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.
- K. The contractor shall cloud all changes made on submittals that are marked "Revise and Resubmit."
- L. Required Submittals: Provide submittals for each item of equipment specified or scheduled in the contract documents. See table at the end of this section.

1.17 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS

- A. Product Listing:
 - 1. Prepare listing of major mechanical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect. A sample schedule is included at the end of this section to complete this requirement.

- a. Provide all information requested.
- b. Submit this listing as a part of the submittal requirement specified in Division 1, "PRODUCTS AND SUBSTITUTION."
- 2. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.
- 3. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units and similar items used in work, except as otherwise indicated.
 - a. Provide products which are compatible within systems and other connected items.
- B. Schedule of Values:
 - 1. Provide preliminary schedule of values with product data submittal, within three (3) weeks from award of contract to successful bidder. Provide according to the following descriptions:
 - a. Site Utilities
 - b. Plumbing
 - 1) Underground rough-in
 - 2) Aboveground rough-in
 - 3) Fixtures
 - 4) Insulation
 - 5) Aboveground finish
 - 6) Fixture set
 - 7) Insulation
 - c. Fire Protection
 - d. Miscellaneous
 - e. Demolition
 - 2. Provide a final Schedule of Values at close-out of project including updated values based on actual installation.
- C. Product Data:
 - 1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
 - 2. Delete or mark-out portions of pre-printed data which are not applicable.
 - 3. Where operating ranges are shown, mark data to show portion of range required for project application.
 - 4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Piping and electrical connection sizes and locations.

- f. Statements of compliance with the required standards and regulations.
- g. Performance data.
- h. Manufacturer's specifications.
- D. Shop Drawings:
 - 1. Shop Drawings are defined as mechanical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
 - 2. Prepare Mechanical Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", unless otherwise noted.
 - a. Show clearance dimensions at critical locations.
 - b. Show dimensions of spaces required for operation and maintenance.
 - c. Show interfaces with other work, including structural support.
- E. Coordination Drawings: See separate paragraph of this specification section.
- F. Test Reports:
 - 1. Submit test reports which have been signed and dated by the accredited firm or testing agency performing the test.
 - 2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
 - 3. Submit test reports as required for O & M manuals.
- G. Operation and Maintenance Data: See separate paragraph of this specification section.
- H. Software Licenses: Provide documentation of ownership under the owner's corporate name (coordinate with owner's representative for exact ownership wording) for Software Licenses provided as part of the work. Include information for updates, subscription requirements if applicable, backup, support, login, passwords, date when purchased, expiration date if applicable, version, etc. Include in the O & M Manual after review and "No Exceptions Taken" has been accomplished.
- I. Record Drawings: See separate paragraph of this specification section.

1.18 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Division 1 Sections on Transportation and Handling and Storage and Protection.
- B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged and protected to prevent damage or contamination during shipment, storage, and handling.
- C. Check delivered equipment against contract documents and submittals.
- D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage, dirt, dust, freezing, heat and moisture. Refer to Division 1 for insurance requirements for offsite storage.
- E. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

- F. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.
- G. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
- H. Protect flanges, fittings and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

1.19 DEMOLITION

- A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
- B. During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, piping and related items either as shown on the demolition drawings as being removed, or as required for the work. These items shall be tagged, protected from damage and stored as directed by the Owner. A list of all items stored shall be turned over to the Architect/Engineer. At the completion of the remodeling work or when directed by the Architect, all stored items not reused or wanted by the Owner shall be removed from the premises.
 - 1. Return all demolished control valves and devices to the Owner.
 - 2. Return existing plumbing fixtures to the Owner.
 - 3. Return existing medical gas outlets to the Owner.
- C. The location of existing equipment, pipes, ductwork, etc., shown on the drawings has been taken from existing drawings and is, therefore, only as accurate as that information. All existing conditions shall be verified from field measurements with necessary adjustment being made to the drawing information.
- D. Hazardous Material: If suspected hazardous material, in any form, is discovered by this Contractor in the process of the work, Contractor shall report such occurrence to the Owner immediately. The Owner will determine the action to be taken for the hazardous material removal, which is not a part of the work to be done under this Division.
- E. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, plumbing fixtures and trim and other mechanical items made obsolete by the new work.
- F. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
- G. Provide and maintain an approved type of temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas. Temporary partitions must not impede access to building egress.
 - 1. ICRA procedures must be maintained during construction.
- H. Locate, identify and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover. Cover openings in piping to remain. Protect equipment and systems to remain.

1.20 CUTTING AND PATCHING

- A. This Article specifies the cutting and patching of mechanical equipment, components and materials to include removal and legal disposal of selected materials, components and equipment. Coordinate the cutting and patching of building components to accommodate the installation of equipment and materials.
- B. Refer to Division 1.
- C. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of plumbing installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective or non-conforming installations.
- F. Perform cutting, fitting and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective work;
 - 3. Remove and replace work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed work as specified for testing;
 - 5. Install equipment and materials in existing structures;
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect /Engineer observation of concealed work.

1.21 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.
- C. Work through all coordination before rough-in begins.

1.22 ACCESSIBILITY

- A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
- B. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, balancing cocks, and other operating devices requiring adjustment or servicing. Refer to Division 8 for access door specification and Division 23 for duct access door requirements.
- C. The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.

- D. Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.
- E. Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed. In lieu of these doors, approved shop fabricated access doors with DuroDyne hinges may be used.
- F. Access doors in fire-rated walls and ceilings shall have equivalent U.L. label and fire rating.
- G. Final installed conditions shall accommodate accessibility and replacement of system components that regularly require service and replacement. This includes control devices, sensors, motors, etc.. Such devices shall not be permanently obstructed by building systems such as piping, ductwork, insulation, drywall, etc.
- 1.23 BELTS, SHEAVES, IMPELLERS
 - A. The Mechanical Contractor shall coordinate with the Test and Balance Contractor and supply correctlysized drive belts, sheaves, and trimmed impellers.
- 1.24 EXCAVATING AND BACKFILLING
 - A. General:
 - 1. Provide all necessary excavation and backfill for installation of mechanical work in accordance with Division 2.
 - 2. In general, follow all regulations of OSHA as specified in "Excavations, Trenching and Shoring." Follow specifications of Division 23 as they refer specifically to the mechanical work.
 - B. Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Also, prior to starting excavation brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.
 - C. Pipe Trenching:
 - 1. Provide all necessary pumping, cribbing and shoring.
 - 2. Walls of all trenches shall be a minimum of 6 inches clearance from the side of the nearest mechanical work. Install pipes with a minimum of 6 inches clearance between them when located in same trench.
 - 3. Dig trenches to depth, width, configuration, and grade appropriate to the piping being installed. Dig trenches to 6inches below the level of the bottom of the pipe to be installed. Install 6 inches bed of pea gravel or squeegee, mechanically tamp to provide a firm bed for piping, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal pipe protrusions.
 - D. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be reviewed by the soils engineer. In no case shall lumber, metal or other debris be buried in with backfill.
 - 1. Provide detectable warning tape for marking and locating underground utilities. Tape shall be specifically manufactured for this purpose and shall be polyethylene film, 6 inches wide, 0.004 inches thick and have a minimum strength of 1750 psi. Tape shall carry continuous inscription naming the specific utility.

- a. Tape shall have magnetic strip and be used for exterior underground system only.
- E. Trench Backfill:
 - 1. Backfill to 12 inches above top of piping with pea gravel or squeegee, the same as used for piping bed, compact properly.
 - 2. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.
- F. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at this contractor's expense.
- G. This contractor shall repair and pay for any damage to finished surfaces.
- H. Complete the backfilling near manholes using pea gravel or squeegee, installing it in 6 inch lifts and mechanically tamping to achieve 95 percent compaction.
- I. Use suitable excavated material to complete the backfill, installed in 6 inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper, 30 inches below paving and slabs and 90 percent elsewhere.

1.25 NAMEPLATE DATA

- A. Provide permanent operational data nameplate, refer to the section on Plumbing Identification, on each item of mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. Coordinate with Owner for specific requirements.
- 1.26 CLEANING
 - A. Refer to Division 1.

1.27 RECORD DOCUMENTS

- A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
- B. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.
- C. Mark Drawing Prints to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, cleanouts, valves, and other control devices, strainers, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., strainers, expansion compensators, tanks, etc.); Change Orders; concealed system devices. Changes to be noted on the drawings shall include final location of any piping relocated more than 1foot-0 inches from where shown on the drawings.

NOTE: REFERENCES TO RFIS, PRs, CHANGE ORDERS, ETC., WILL NOT BE ACCEPTED AS ASBUILT CONDITIONS.

- D. Mark shop drawings to indicate approved substitutions; Change Orders; actual equipment and materials used.
- E. Mark equipment and fixture schedules on drawings to indicate manufacturer and model numbers of installed equipment and fixtures.
- F. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme:
 - 1. Red shall indicate new items, deviations and routing.
 - 2. Green shall indicate items removed or deleted.
 - 3. Blue shall be used for relevant notes and descriptions.
- G. At the completion of the project, obtain from the Architect a complete set of the Mechanical Contract Documents in a read-only electronic format (.pdf unless otherwise noted). This set will include all revisions officially documented through the Architect/Engineer. Using the above color scheme, transfer any undocumented revisions from the construction site record drawings to this complete set. Submit completed documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed
- H. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up .pdf format readable by Bluebeam is preferred.

1.28 OPERATION AND MAINTENANCE DATA

- A. Refer to Division 1.
- B. No later than four (4) weeks prior to the completion of the project provide one complete set of Operating and Maintenance Manuals, or as specified in Sections of Division 1 (whichever is more stringent).
- C. The testing and balancing report shall be submitted and received by the Engineer at least fifteen calendar days prior to the contractor's request for final observation time frame requirements. Include in the O & M Manual after review with "No Exceptions Taken" has been accomplished.
- D. In addition to the information required by Division 1 for Maintenance Data, include the following information:
 - 1. The job name and address and contractor's name and address shall be identified at the front of the electronic submittal.
 - Description of equipment, function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 3. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions. Provide any test reports and start-up documents.
 - 4. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
 - 5. Servicing instructions, lubrication charts and schedules, including Contractor lubrication reports.
 - 6. Manufacturer's service manuals for all equipment provided under this contract.
 - 7. Include the valve tag list.
 - 8. Name, Address and Telephone numbers of the Sub-contractors and local company and party to be contacted for 24-hour service and maintenance for each item of equipment.

- 9. Starting, stopping, lubrication, equipment identification numbers and adjustment clearly indicated for each piece of equipment.
- 10. Complete recommended spare parts list.
- 11. Mechanical System and Equipment Warranties.
- 12. Copies of all test reports shall be included in the manuals.
- 13. Provide manuals with dividers for major sections and special equipment. Mark the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
- 14. Final schedule of values with all mechanical change order costs included and identified.
- 15. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up PDF format readable by Bluebeam is preferred.
- 16. Backflow preventor test certification.
- E. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, and final Schedule of Values with all Electrical and Information Technology change order costs included and identified is provided and the manual is reviewed by the Architect/Engineer.

1.29 PROJECT CLOSEOUT LIST

- A. In addition to the requirements specified in Division 1, complete the requirements listed below.
- B. The Contractor shall be responsible for the following Plumbing Submittal Checklist either by performing and/or coordinating such items prior to applying for certification of substantial completion. Refer to individual specification sections for additional requirements. (Checklist is located at the end of this section.)

1.30 WARRANTIES

- A. Refer to the Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In any case the entire plumbing system shall be warranted no less than one year from the time of acceptance by the Owner.
- B. Compile and assemble the warranties specified in Division 21, 22, and 23, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference or include the Operating and Maintenance Manuals.
- C. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.31 CONSTRUCTION REQUIREMENTS

- A. The contractor shall maintain and have available at the jobsite current information on the following at all times:
 - 1. Up to date record drawings.
 - 2. Submittals
 - 3. Site observation reports with current status of all action items.
 - 4. Test results; including recorded values, procedures, and other findings.
 - 5. Outage information.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
- 2.2 PIPE, TUBE, AND FITTINGS
 - A. Refer to individual Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
 - B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
 - 1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
 - 2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
 - 1. Available Manufacturers:
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser Industries, Inc.; DMD Div.
 - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.

- d. JCM Industries.
- e. Smith-Blair, Inc.
- f. Viking Johnson.
- 2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
- 3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
- 4. Aboveground Pressure Piping: Pipe fitting.

2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Eclipse, Inc.
 - d. Epco Sales, Inc.
 - e. Hart Industries, International, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Industries, Inc.; Wilkins Div.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070kPa) minimum working pressure as required to suit system pressures.
 - 1. Available Manufacturers:
 - a. Capitol Manufacturing Co.
 - b. Central Plastics Company.
 - c. Epco Sales, Inc.
 - d. Watts Industries, Inc.; Water Products Div.
- E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ringtype neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070kPa) minimum working pressure where required to suit system pressures.
- F. 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).

- 1. Available Manufacturers:
 - a. Calpico, Inc.
 - b. Lochinvar Corp.
- G. 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).
 - 1. Available Manufacturers:
 - a. Perfection Corp.
 - b. Precision Plumbing Products, Inc.
 - c. Sioux Chief Manufacturing Co., Inc.
 - d. Victaulic Co. of America.

2.6 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
 - 1. Available Manufacturers:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Plastic Carbon steel or Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.7 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.
- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.8 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Stainless-Steel Type: With polished stainless-steel finish.
- C. One-Piece, Deep-Pattern Type: Deep-drawn, steel chrome plated spring clip fasteners, box-shaped brass with polished chrome-plated finish.
- D. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated, Rough brass or Polished chrome-plated and rough brass.
- E. One-Piece, Stamped-Steel Type: With set screw and chrome-plated finish.
- F. Split-Plate, Stamped-Steel Type: With concealed hinge, set screw or spring clips, and chrome-plated finish.
- G. One-Piece, Floor-Plate Type: Cast-iron floor plate.
- H. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.9 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

- 3.1 PIPING SYSTEMS COMMON REQUIREMENTS
 - A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
 - B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
 - C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
 - D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
 - 1. New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
 - c. Insulated Piping: One-piece, stamped-steel type with spring clips.
 - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel or stainless steel type.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel or stainless steel type and set screw.
 - f. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel or stainless steel type with concealed hinge and set screw or spring clips.
 - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
 - h. Bare Piping in Equipment Rooms: One-piece, stamped-steel or stainless steel type with set screw or spring clips.
 - i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
 - 2. Existing Piping: Use 2-piece hinged chrome plated steel escutcheons.
- M. Sleeves are not required for core-drilled holes.
- N. Permanent sleeves are not required for holes formed by removable PE sleeves.
- O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
 - 3. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
 - a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6.

- b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.
- 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 for materials and installation.
- P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
 - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
 - 2. Install cast-iron "wall pipes" for sleeves 6 inchesand larger in diameter.
 - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Rated Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

- H. Non-Pressure PVC Joints: Clean and dry joints and surfaces. Make joints complying with ASTM F402 Safe Practices for Cleaners, Primers, and Cements. Join PVC in accordance with ASTM D2855 and D2665. Remove burrs and cuttings prior to joint pipe and fittings
- I. Hubless Cast Iron: Join in accordance with CISPI Handbook for Cast Iron Soil Pipe and Fittings and CISPI 310.
- J. Hub and Spigot Cast Iron: Join gasketed joints in accordance with CISPI Cast Iron Soil Pipe and Fittings Handbook
- K. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
 - 1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
 - 2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
 - 3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
 - 4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.
- 3.4 EQUIPMENT INSTALLATION COMMON REQUIREMENTS
 - A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
 - B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
 - C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
 - D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09.
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.

- 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
- 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
- 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- 7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement.

3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

3.8 GROUTING

- A. Mix and install grout for plumbing equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

3.9 MECHANICAL SUBMITTAL CHECKLIST

	Item	Requirements							
Spec Section		Submittals			Supplemental		Factory Rep	Training	Extra
		Shop Drawings	Product Data	Include In O & M	Test ³	Report ³	Super- Vision At Site	Req'd At Site	t Material
220500	Common Work Results For Plumbing	Х	Х	Х					
220500	Preliminary Schedule of Values	х	х			х			
220500	Final Schedule of Values	Х	х	х		Х			
220500	O&M Manuals		х	х		х			х

	Item	Requirements							
Spec Section		Submittals			Supplemental		Factory Rep	Training	Extra
		Shop Drawings	Product Data	Include In O & M	Test ³	Report ³	Super- Vision At Site	Req'd At Site	Material
220500	Coordination Drawings	х							
220500	Record Drawings	х	Х	х					
220509	Firestopping	Х	Х	Х					
220523	General duty Valves for Plumbing		Х	х					
220529	Hangers & Supports for Plumbing & Piping Equipment		Х	х					
220553	Identification for Plumbing		Х	Х					
220700	Plumbing Insulation		Х	х					
221116	Domestic Water Piping		Х	X					
221119	Domestic Water Piping Specialties		Х	Х					
221316	Sanitary Waste and Vent Piping		Х	Х					
221413	Facility Storm Drainage Piping		Х	Х					
224000	Plumbing Fixtures		Х	Х					х
226000	Gas and Vacuum Systems		Х	х	Х	х		Х	
Notes:	 ¹ For Starters and Variable Frequere Requires Review & Approval of ³ See Specific Specification Sect 	iency Drives calibrated balan ion for Test & Ce	ce valves from ⁻ ertification Requi	T & B Contractor rements					

END OF SECTION 220500

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SECTION 220509 - PLUMBING FIRE STOPPING

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK
 - A. Extent of firestopping required by this section is indicated on the drawings and by the requirements of this section. Refer to architectural plans and specifications for additional information.
 - B. Types of firestopping systems specified in this section include:
 - 1. Bare metal pipe
 - 2. Insulated metal pipe
 - 3. Plastic piping

1.2 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacturing of firestopping systems for mechanical/electrical penetrations, whose products have been in satisfactory use for not less than 5 years, with published application data for all types of penetrations to be encountered on this job, and with local representation capable of providing training and technical assistance at the job site.
- **B.** Installer's Qualifications: Personnel installing firestopping systems shall have been specifically trained by the manufacturer in the application of the materials to comply with the listing of the tested assembly.
- C. Codes and Standards: Comply with the applicable State and Local codes pertaining to firestopping. Firestopping systems shall be tested and listed in accordance with the following:
 - 1. Underwriter's Laboratory:
 - a. UL 1479 test method for fire tests of through-penetration firestops.
 - b. UL Fire Resistance Directory
 - 2. American Society for Testing and Materials:
 - a. ASTM E814-88 Standard test method for fire tests of through-penetration firestops.
 - b. ASTM E2174 Standard practice for onsite inspection of firestop systems.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
- B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware and installation procedures, plus the following specific requirements:
 - 1. Details of each proposed assembly, for all types of fire rated construction and penetrating items encountered, identifying intended products and applicable UL System Number, or UL classified devices.

2. Manufacture or manufacturer's representative shall provide qualified engineering judgments and drawings relating to non-standard applications as needed.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Packing and Shipping:
 - 1. Deliver products in original, unopened packaging with legible manufacturer's identification.
 - 2. Coordinate delivery with scheduled installation date, allow minimum storage at site.
- B. Storage and Protection: Store materials in a clean, dry ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.5 PROJECT CONDITIONS

- A. Existing Conditions:
 - 1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
 - 2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- B. Environmental Requirements:
 - 1. Furnish adequate ventilation if using solvent.
 - 2. Furnish forced air ventilation during installation if required by manufacturer.
 - 3. Keep flammable materials away from sparks or flame.
 - 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
 - 5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the requirements of this specification, provide products by one of the following:
 - 1. 3M, Fire Protection Products
 - 2. Nelson Firestop Products
 - 3. TREMCO Construction Products
 - 4. Metalines
 - 5. Hilti Corporation
 - 6. Specified technologies, Inc. (STI)
- 2.2 GENERAL
 - A. Provide fire stop systems listed in the UL Fire Resistance Directory. Provide systems with fire resistance "F" ratings equal to the fire resistance rating of the wall or floor assembly for all penetrations. In addition, provide systems with a "T" rating equal to the fire resistance rating of the floor assembly for all floor penetrations not within the cavity of a wall.

2.3 ACCESSORIES

A. Provide forming and damming materials and sleeves as required by the firestopping system installation instructions.

PART 3 - EXECUTION

3.1 GENERAL

- A. Review all project drawings, Owner's records and existing conditions to determine location, rating, and construction of all fire resistive construction.
- B. Coordinate location of penetrations to allow for the maximum and minimum annular space around the penetrating item. Allow a minimum of 1" undisturbed building material between penetrations, or provide a firestopping system listed for multiple penetrations. Penetrating items shall be centered in hole as much as practical, unless firestopping system is listed for point contact between the wall/floor assembly and the penetrating item.
- C. Neatly form, saw cut, hole saw or core drill openings. Size openings to conform with the maximum and minimum annular space requirements of the firestopping system.

3.2 APPLICATION

- A. The Contractor shall determine the most appropriate firestopping system which complies with these specifications and requirements for system being installed.
- B. All insulation shall be continued through the penetration. Provide intumescent caulk or collar firestopping systems. Where the insulation thickness specified in Section 22 07 00 exceeds the allowable insulation thickness for the firestopping system, reduce the insulation thickness 6 inches on either side of the penetration. Do not reduce insulation to less than 50 percent of the specified thickness.
- C. Provide collar type firestopping systems where shown on drawings, and for hot piping systems at penetrations where significant thermal movement can be expected, such as near expansion compensation loops or joints.
- D. See Section 220500 for sleeves. The use of sleeves may affect the "T" rating of the firestopping system. Coordinate use of sleeves with firestopping.

END OF SECTION 220509

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SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Bronze ball valves.
- B. Related Sections
 - 1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
 - 2. Section 221023 "Plumbing Pumps"
 - 3. Section 221116 "Domestic Water Piping" for valves applicable only to this piping.
 - 4. Section 221319 "Sanitary Waste Piping Specialties" for valves applicable only to this piping.
 - 5. Section 221423 "Storm Drainage Piping Specialties" for valves applicable only to this piping.
 - 6. Section 221513 "General-Service Compressed-Air Piping" for valves applicable only to this piping.
 - 7. Section 226000 "Gas and Vacuum Systems for Laboratory and Healthcare Facilities" for valves applicable only to this piping.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. SWP: Steam working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
 - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
 - 2. ASME B31.1 for power piping valves.
 - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set ball valves open to minimize exposure of functional surfaces.
 - 4. Set butterfly valves closed or slightly open.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use levers or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Bronze Ball and Check Valves:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.
 - c. Hammond Valve.
 - d. Lance Valves.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.

2.2 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.

- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.
 - 3. Handlever: For quarter-turn valves NPS 6 and smaller.
 - 4. Chainwheel: Device for attachment to valve handwheel, stem, or other actuator; of size and with chain for mounting height, as indicated in the "Valve Installation" Article.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 - 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 - 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 - 2. Solder Joint: With sockets according to ASME B16.18.
 - 3. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.3 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig
 - c. CWP Rating: 200 psig
 - d. Body Design: Two piece.
 - e. Body Material: Bronze.
 - f. Ends: Solder joint.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Chrome plated brass
 - j. Port: Full.
- B. Three-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
 - 1. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig
 - c. CWP Rating: 600 psig
 - d. Body Design: Three piece.
 - e. Body Material: Bronze.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Bronze.
 - i. Ball: Chrome-plated brass.
 - j. Port: Full.

2.4 DRAIN VALVES

A. For Plumbing Systems: Provide ball valve with threaded hose end and cap with chain.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install chainwheels on operators for ball, butterfly valves NPS 4 and larger and more than 96 inches above floor. Extend chains to 60 inches above finished floor.
- F. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.
 - 2. Center-Guided Check Valves: In horizontal or vertical position, between flanges.
 - 3. Lift Check Valves: With stem upright and plumb.

3.3 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. Use the following valves for series indicated
 - 1. Plumbing Water Services: 3" and smaller: Ball Valve
 - 2. Plumbing Water Services; 2-1/2" and larger: Butterfly valve or Ball Valve
 - 3. Plumbing Bypass; all sizes: Globe Valve
 - 4. Plumbing Balancing: Calibrated Balancing Valve
 - 5. Pump-Discharge Check Valves:
 - a. NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc.
 - b. NPS 2-1/2 and Larger for Domestic Water: Iron swing check valves with lever and weight or with spring or iron, center-guided, resilient-seat check valves.
 - c. NPS 2-1/2 and Larger for Sanitary Waste and Storm Drainage: Iron swing check valves with lever and weight or spring.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valveend option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Copper Tubing, NPS 5 and Larger: Flanged ends.
 - 4. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 5. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 6. For Steel Piping, NPS 5 and Larger: Flanged ends.

3.5 LOW-PRESSURE, COMPRESSED-AIR VALVE SCHEDULE (150 PSIG OR LESS)

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 - 3. Bronze Lift Check Valves: Class 125, nonmetallic disc.
 - 4. Bronze Swing Check Valves: Class 125 or Class 150, nonmetallic disc.

3.6 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
 - 3. Bronze Swing Check Valves: Class 125 or Class 150, nonmetallic disc

END OF SECTION 220523

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SECTION 220700 - PLUMBING INSULATION

- PART 1 GENERAL
- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section Includes:
 - 1. Insulation Materials:
 - a. Calcium silicate.
 - b. Fiberglass/ Mineral fiber
 - c. Flexible elastomeric
 - 2. Insulating cements.
 - 3. Adhesives.
 - 4. Mastics.
 - 5. Lagging adhesives.
 - 6. Sealants.
 - 7. Factory-applied jackets.
 - 8. Field-applied jackets.
 - 9. Tapes.
 - 10. Securements.
 - B. Related Sections include the following:
 - 1. Division 22 Section "Hangers and Supports for Plumbing and Piping Equipment"
 - 2. Division 23 Section "HVAC Insulation."
 - C. Definitions
 - 1. ASJ: All Surface Jacket.
 - 2. FSK: Foil Scrim Kraft.
 - 3. MRT: Mean Temperature Rating.
 - 4. NRTL: Nationally Recognized Testing Laboratory
 - 5. PCF: Pounds per Cubic Foot.
 - 6. PSF: Pounds per Square Foot.
 - 7. SSL: Self sealing Lap
 - D. Codes and Standards:
 - 1. International Energy Conservation Code, currently adopted version.
 - 2. ASHRAE 90.1, latest edition.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).

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- B. 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 and test methods employed.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products and systems, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
- C. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-testresponse characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
 - 1. Insulation: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, fire hazard indexes and maximum use temperature.
 - B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing if any.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
 - 1. Mechanical Insulation:
 - a. Aeroflex.
 - b. Armacell
 - c. CertainTeed
 - d. Einsulation
 - e. Johns Manville Corp.
 - f. Knauf Fiber Glass
 - g. Manson
 - h. Owens-Corning Fiberglas Corp.
 - i. Pittsburgh Corning Corp.
 - j. PABCO, Inc.
 - k. Rubatex Corp.
 - I. Thermal Structures
 - 2. Jacketing & Covering Products:
 - a. Alpha Associates, Inc.
 - b. Ceel-Co
 - c. Childers
 - d. Polyguard
 - e. Venture Tape
 - f. Zeston
 - 3. Insulating Cement :
 - a. Insulco,
 - b. P.K. Insulation Mfg. Co., Inc.
 - c. Rock Wool Manufacturing Company
 - 4. Adhesives, Mastics, Sealants:
 - a. Childers Products, Fimasco Corporation
 - b. Foster Products Corporation, H.B. Fuller Company
 - c. ITW TACC, Division of Illinois Tool Works
 - d. Marathon Industries, Inc.
 - e. Mon-Eco Industries, Inc.
 - 5. Tapes :
 - a. Avery Dennison Corporation, Specialty Tapes Division
 - b. Compac Corp.
 - c. Ideal Tape Co., Inc. An American Bilrite Company
 - d. Venture Tape
 - 6. Field Applied Cloths :
 - a. Alpha Associates, Inc.

- 7. Field Applied Jackets :
 - a. Childers Products
 - b. Johns Mansville
 - c. PABCO Metals Corporation
 - d. P.I.C. Plastics, Inc.
 - e. Proto PVC Corporation
 - f. RPR Products, Inc.
 - g. Speedline Corporation
- 8. Securement :
 - a. C&F Wire
 - b. Childers Products
 - c. PABCO Metals Corporation
 - d. RPR Products, Inc.

2.2 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Fiberglass Piping Insulation: ASTM C 547, Class 1 unless otherwise indicated. ASJ-SSL Jacket with tensile strength of 35 lbs/in, mullen burst 70 psi, Beach Units puncture 50 oz. in/in, permeability 0.02 perm factory applied vapor barrier jacket and adhesive self-sealing lap joint. "K" factor shall be maximum 0.23 at 75°F MRT, 0.24 at 100°F MRT, 0.29 at 200°F MRT and 0.36 at 300°F MRT.
- F. Cellular Glass Piping Insulation: ASTM C 552, Type II, Class 2. Permeability of 0.00 perm. Preformed pipe insulation with factory-applied all-service jacket with self-sealing lap. "K" factor shall be maximum 0.28 at 50°F MRT, 0.29 at 75°F MRT, 0.31 at 100°F MRT, 0.38 at 200°F MRT and 0.45 at 300°F MRT.
- G. Flexible Elastomeric, Closed Cell Piping Insulation: ASTM C 534. Water vapor permeability of 0.10 perm inches or less. Insulation shall be pre-installed on piping, or un-slit to be slipped over piping as a single piece. "K" factor shall be maximum 0.245 at 50°F MRT, 0.25 at 75°F MRT and 0.26 at 90°F MRT.
- H. Calcium Silicate:
 - 1. Preformed Pipe Sections: Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 2. Flat-, curved-, and grooved-block sections of noncombustible, inorganic, hydrous calcium silicate with a non-asbestos fibrous reinforcement. Comply with ASTM C 533, Type I.
 - 3. Prefabricated Fitting Covers: Comply with ASTM C 450 and ASTM C 585 for dimensions used in preforming insulation to cover valves, elbows, tees, and flanges.

I. Mineral-Fiber, Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied FSK jacket complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.3 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.

2.4 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 1. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
 - 1. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-C-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
 - 1. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.
 - 2. Service Temperature Range: Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C).
 - 3. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
 - 4. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - 4. Color: Aluminum.

- 5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. ASJ Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
 - 4. Color: White.
 - 5. For indoor applications, use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
 - 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
 - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd. with adhesive, sealant, and cement as recommended by insulation manufacturer for application.
- 2.9 FIELD-APPLIED JACKETS
 - A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
 - B. PVC Fitting Covers: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C.
 - 1. Adhesive: As recommended by jacket material manufacturer.
 - 2. Color: White.
 - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.10 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 - 1. Width: 3 inches
 - 2. Thickness: 11.5 mils
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

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- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 3 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.
 - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
 - 1. Width: 2 inches.
 - 2. Thickness: 6 mils
 - 3. Adhesion: 64 ounces force/inch in width.
 - 4. Elongation: 500 percent.
 - 5. Tensile Strength: 18 lbf/inch in width.

2.11 SECUREMENTS

- A. Bands:
 - 1. Aluminum: ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing or closed seal.
 - 2. Stainless: ASTM A 167 or A240/A 240M. type 305 or 315, 0.015 inches thick, 3/4" wide with wing or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.080-inch nickel-copper alloy, 0.062-inch soft-annealed, stainless steel or 0.062-inch soft-annealed, galvanized steel.

2.12 EQUIPMENT INSULATION MATERIALS

- A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Class 2. "K" factor shall be maximum 0.28 at 200°F mean temperature, 3.0 PCF density, 850°F temperature limit.
- B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type I, "K" factor shall be maximum 0.45 at 250°F mean temperature. 850°F temperature limit.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
 - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
 - 2. Verify that surfaces to be insulated are clean and dry.
 - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. All systems shall be insulated in accordance with the locally adopted energy codes or requirements of this specification section, whichever is more stringent.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment and piping including fittings, valves, and specialties.
- C. Insulation shall be installed to allow maintenance and replacement of system components without compromising the insulation integrity or vapor barrier on cold systems.
- D. Workmanship shall be first class and of the highest quality, poor installation or bad appearance as determined by the engineer shall be due cause to reject the entire project in whole and retainage will be withheld until corrective action is completed to the engineer's satisfaction.
- E. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- F. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- G. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- H. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- I. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- J. Install multiple layers of insulation with longitudinal and end seams staggered.
- K. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- L. Keep insulation materials dry during application and finishing.
- M. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- N. Install insulation with least number of joints practical.

- O. Maintain integrity of vapor barrier jackets on cold pipe insulation, and protect to prevent puncture or other damage.
 - 1. Do not use staples or tacks on vapor barrier jackets.
 - 2. Seal vapor barrier penetrations with vapor barrier finish recommended by the manufacturer.
 - 3. Seal fitting covers with PVC tape.
 - 4. Cover all unions, check valves, and other in-line devices. Mark outer covering with indelible marker to identity item covered.
- P. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- Q. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- R. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- S. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- T. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- U. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- V. For above ambient services, do not install insulation to the following:

- 1. Vibration-control devices.
- 2. Testing agency labels and stamps.
- 3. Nameplates and data plates.
- 4. Manholes.
- 5. Handholes.
- 6. Cleanouts.

3.4 PENETRATIONS

- A. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- B. Insulation Installation at Non-Fire Rated Interior Wall and Partition Penetrations: Install insulation continuously through walls and partitions.
- C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
 - 1. Comply with requirements in Divisions 07 and 22 for Firestopping and fire-resistive joint sealers.

3.5 GENERAL PIPE INSULATION INSTALLATION

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.
- C. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- D. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

- 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
- 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
- 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
- 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- 8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- 9. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- E. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- F. Install removable insulation covers at locations indicated. Installation shall conform to the following:
 - 1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
 - 2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
 - 3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
 - 4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 FLEXIBLE ELASTOMERIC PIPING INSULATION

- A. Install unslit, by slipping over piping prior to joining, or install pre-insulated soft copper tubing.
- B. Seal butt ends with adhesive.

3.7 CELLULAR GLASS INSULATION

- A. Apply in a single layer. Secure to pipe with 1/2 inch wide aluminum bands.
- B. For all applications, apply all-purpose Kraft paper/aluminum foil/vinyl coating ASJ jacket. Seal all lap and butt joints with self-seal vapor barrier tape.

3.8 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
 - 1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
 - 2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
 - 3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
 - 4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- B. Insulation Installation on Pipe Fittings and Elbows:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- C. Insulation Installation on Valves and Pipe Specialties:
 - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
 - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
 - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 - 4. Install insulation to flanges as specified for flange insulation application.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
 - 1. Underground piping unless noted otherwise

2. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. All Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation with ASJ-SSL Jacket: 1 inch thick.
- B. Domestic Hot and Recirculated Hot Water (140°F and lower):
 - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation with ASJ-SSL Jacket: 1 inch thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation with ASJ-SSL Jacket: 1-1/2 inch thick.
- C. Stormwater and Overflow:
 - 1. All Pipe Sizes: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe Insulation with ASJ-SSL Jacket: 1 inch thick; 0.5 in minimum if approved.
- D. Roof Drain and Overflow Drain Bodies:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Mineral-Fiber, Pipe Insulation with ASJ-SSL Jacket: 1 inch thick; 0.5 inch minimum if approved.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities, pre-manufactured trap insulation kit.

3.11 EXISTING INSULATION REPAIR:

- A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation, install new jacket lapping and sealed over existing.
- B. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- C. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 220700

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SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
 - 2. Encasement for piping.
- B. Related Requirements:
 - 1. Site/Civil documents for water-service piping outside the building from source to the point where water-service piping enters the building.

1.3 ACTION SUBMITTALS

A. Product Data: Submit industry standard and manufacturers technical product data, installation instructions, and dimensional drawings for each type of pipe and fittings. Submit schedule showing pipe or tube weight, fittings and joint type for each piping system.

1.4 INFORMATIONAL SUBMITTALS

- A. Refer to Division 1, Section 220500 "Common Work Results for Plumbing", and Basic Requirements for administrative and procedural requirements for submittals
- B. Certification of Compliance with ASME, NSP-61 and UL fabrication requirements.
- C. Welding Certifications: Submit reports as required for piping work
- D. Brazing Certifications: Submit reports a required for piping work.
- E. Test reports as specified in Part 3 of this section
- F. Manufacturer and product data for lead free solder with material breakdown.
- G. System purging and disinfecting activities report.
- H. Field quality-control reports.
- 1.5 FIELD CONDITIONS
 - A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:

- 1. Notify Construction Manager no fewer than two days in advance of proposed interruption of water service.
- 2. Do not interrupt water service without Construction Manager's written permission.

1.6 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with the provisions of the following:
 - 1. Currently adopted local plumbing code
 - 2. NSF Standard 61: "Drinking Water System Components"
 - 3. ASME B 31.9 "Building Services Piping" for materials, products and installation. Safety valves and pressure vessels shall bear the appropriate ASME label.
 - 4. ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualification" for Qualifications for Welding Processes and Operators
 - 5. ASSE Compliance: Comply with applicable ASSE Standards pertaining to materials, products and installation of water distribution systems.
 - 6. Local utility Department requirements
 - 7. Local Cross Connection Control Manual
 - 8. Local Engineering Standards
- B. Manufacturers Qualifications: Firms regularly engaged in manufacture of pipes and pipe fittings of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- C. Each manufacturer or contractor shall be responsible for the quality of soldering and brazing done by their organization and shall repair or replace any work not in accordance with these specifications.
- D. Soldering and Brazing procedures shall conform to ANSI Standard Safety Code for Mechanical Refrigeration.

1.7 DELIVER, STORAGE AND HANDLING

- A. Store pipe in manner to prevent sagging and bending
- B. Cap ends of piping when being stored.
- C. Store all materials per manufacturer's recommendations

1.8 SEQUENCING AND SCHEDULING

- A. Coordinate the size and location of concrete equipment pads. Cast anchor bolt inserts into pad, minimum of 6" from edges. Concrete, reinforcement and formwork requirements are specified in Division 3.
- B. Coordinate the installation of pipe sleeves for foundation wall and floor penetrations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Sleeve Type Transition Coupling
 - a. Cascade Waterworks Mfg. Co.
 - b. Dresser, Inc.
 - c. Ford Meter Box Company, Inc. (The).
 - d. Jay R. Smith Mfg. Co.
 - e. JCM Industries, Inc.
 - f. Romac Industries, Inc.
 - g. Smith-Blair, Inc.
 - h. Viking Johnson.
 - 2. Plastic to Metal Transition Fittings:
 - a. Charlotte Pipe and Foundry Company.
 - b. Harvel Plastics, Inc.
 - c. Spears Manufacturing Company.
 - d. Uponor.
 - 3. Dielectric Flanges
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Matco-Norca.
 - d. Watts; a Watts Water Technologies company.
 - e. Wilkins.
 - f. Zurn Industries, LLC.
 - 4. Dielectric Flange Insulating Kits
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Central Plastics Company.
 - d. Pipeline Seal and Insulator, Inc.
 - 5. Dielectric Nipples
 - a. Elster Perfection Corporation.
 - b. Grinnell Mechanical Products.
 - c. Matco-Norca.
 - d. Precision Plumbing Products.
 - e. Victaulic Company.
 - 6. Copper Pressure Sealed Joints
 - a. Apollo
 - b. Viega
 - c. NIBCO

2.2 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type L (ASTM B 88M, Type B) and ASTM B 88, Type K (ASTM B 88M, Type A) water tube, drawn temper.
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- E. Copper Unions:
 - 1. MSS SP-123.
 - 2. Cast-copper-alloy, hexagonal-stock body.
 - 3. Ball-and-socket, metal-to-metal seating surfaces.
 - 4. Solder-joint or threaded ends.
- F. Standard Pattern, Mechanical Joint Fittings
 - 1. AWWA C110/A21.10 ductile or gray iron
 - 2. Glands, Gaskets and Bolts: AWWA C111/A21.11, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- G. Push on Joint, Ductile Iron Pipe:
 - 1. AWWA C151/A21.51
 - 2. Push on joint bell and plain spigot end unless grooved or flanged ends are indicated.
- H. Standard Pattern Push on Joint Fittings:
 - 1. AWWA C110/A21.10, ductile or gray iron
 - 2. Gaskets: AWWA C111/A21.11, rubber
- I. Plain End, Ductile Iron Pipe: AWWA C151/A21.51
- J. Grooved Pipe Fittings and Couplings:
 - 1. Fittings for Grooved End Ductile Iron Pipe: ASTM A47/ A47M, malleable iron castings or ASTM A 536, ductile iron castings with dimensions that match pipe.
 - 2. Mechanical Couplings for Grooved End, Ductile Iron Piping
 - a. AWWA C606 for ductile iron pipe dimensions
 - b. Ferrous housing sections
 - c. EPDM rubber gaskets suitable for hot and cold water
 - d. Bolts and nuts
 - e. Minimum Pressure Rating: 150 psig

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

- 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
- 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
- 2.5 ENCASEMENT FOR PIPING
 - A. Standard: ASTM A 674 or AWWA C105/A21.5.
 - B. Form: tube.
 - C. Color: natural.
- 2.6 TRANSITION FITTINGS
 - A. General Requirements:
 - 1. Same size as pipes to be joined.
 - 2. Pressure rating at least equal to pipes to be joined.
 - 3. End connections compatible with pipes to be joined.
 - B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
 - C. Sleeve-Type Transition Coupling: AWWA C219.
 - D. Plastic-to-Metal Transition Fittings:
 - 1. Description:
 - a. CPVC or PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
 - b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Flanges:
 - 1. Standard: ASSE 1079.
 - 2. Factory-fabricated, bolted, companion-flange assembly.
 - 3. Pressure Rating: 175 psig (1200 kPa).
 - 4. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

- C. Dielectric-Flange Insulating Kits:
 - 1. Nonconducting materials for field assembly of companion flanges.
 - 2. Pressure Rating: 150 psig (1035 kPa).
 - 3. Gasket: Neoprene or phenolic.
 - 4. Bolt Sleeves: Phenolic or polyethylene.
 - 5. Washers: Phenolic with steel backing washers.
- D. Dielectric Nipples:
 - 1. Standard: IAPMO PS 66.
 - 2. Electroplated steel nipple complying with ASTM F 1545.
 - 3. Pressure Rating and Temperature: 300 psig (2070 kPa) at 225 deg F (107 deg C).
 - 4. End Connections: Male threaded or grooved.
 - 5. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Civil documents and Section 220500 for excavating, trenching, and backfilling. At minimum, provide 6" sand bed prior to backfill with native soil.

3.2 EXAMINATION

- A. Verify all dimensions by field measurements. Verify that all water distribution piping may be installed in accordance with pertinent codes and regulations, the original design and the applicable referenced standards.
- B. Examine rough-in requirements for plumbing fixtures and other equipment having water connections to verify actual locations of piping connections prior to installation
- C. Do not proceed until unsatisfactory conditions have been corrected.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
- E. Install drains in pressure pipe systems at al low points in mains and risers consisting of a tee fitting, 3/4 inch ball valve, and short 3/4 inch threaded end nipple and cap with chain.

- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- H. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- I. Install piping at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- J. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- K. Install piping to permit valve servicing.
- L. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- P. Fire and Smoke Wall Penetrations: Where pipes pass through fire and smoke rated walls, partitions, ceilings, and floors, maintain the fire and smoke rated integrity. Refer to Section 220509 for materials.
- Q. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
- R. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220500.
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220500.
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220500.
- V. Install PEX with loop at change in direction of more than 90 degrees.

3.4 SERVICE ENTRANCE

A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Coordinate final connection location with Utilities Contractor. Water service piping is specified in Division 2

- B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation shown on mechanical drawings.
- C. Install shutoff valve at service entrance inside building; complete with strainer, pressure gauge and test tee with valve.
- D. Ductile-Iron Pipe: Install in accordance with AWWA C-60.
- E. Provide thrust blocks on underground water piping at each change in direction and where shown on the drawings.
- F. Coordinate foundation and all other structural penetrations with structural engineer.

3.5 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
- E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- G. Joints for PEX piping; Join in accordance with ASTM F 1960 cold expansion fittings and reinforcing rings.
- 3.6 TRANSITION FITTING INSTALLATION
 - A. Install transition couplings at joints of dissimilar piping.
 - B. Transition Fittings in Underground Domestic Water Piping:
 - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
 - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- 3.7 DIELECTRIC FITTING INSTALLATION
 - A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
 - B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.8 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
 - 1. Vertical Piping: MSS Type 8 or 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis or band hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
 - 7. NPS 8: 10 feet with 3/4-inch rod.
- F. Install supports for vertical copper tubing every 10 feet
- G. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.
- 3.9 CONNECTIONS
 - A. Drawings indicate general arrangement of piping, fittings, and specialties.
 - B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
 - C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
 - D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

- 1. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
- 2. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.
- E. Provide hot and cold water piping runouts to fixtures of sizes indicated, but in no case smaller than required by Plumbing Code. For fixtures with hot water service, extend hot water recirculation line out to fixtures greater than 20' away from main or loop hot water line down to the fixture.
- F. Connect hot and cold water piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connection, provide drain valve on drain connection. Provide backflow preventor as shown as required. For connections 2-1/2" and larger, use flanges instead of unions.
- 3.10 IDENTIFICATION
 - A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
 - B. Label pressure piping with system operating pressure.
- 3.11 FIELD QUALITY CONTROL
 - A. Perform the following tests and inspections:
 - 1. Piping Inspections:
 - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 - Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
 - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
 - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
 - 2. Piping Tests:
 - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
 - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

- c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
- e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
- f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.12 ADJUSTING

- A. Perform the following adjustments before operation:
 - 1. Close drain valves, hydrants, and hose bibbs.
 - 2. Open shutoff valves to fully open position.
 - 3. Open throttling valves to proper setting.
 - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
 - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
 - b. Adjust calibrated balancing valves to flows indicated.
 - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
 - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
 - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
 - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.13 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Fill and isolate system according to either of the following:
 - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
 - 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
 - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.

- d. Repeat procedures if biological examination shows contamination.
- e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
 - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
 - 2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
 - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
 - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.14 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Under-building-slab, domestic water, building-service piping, NPS 3 (DN 80) and smaller, shall be one of the following:
 - 1. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solderjoint fittings; and brazed joints. Piping shall be installed in 10 mil poly sleeve.
- D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 (DN 100 to DN 200) and larger, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solderjoint fittings; and brazed joints. Piping shall be installed in 10 mil poly sleeve
- E. Underground, domestic water piping, NPS 6 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type K (ASTM B 88M, Type A); wrought-copper, solderjoint fittings; and brazed joints. Piping shall be installed in 10 mil poly sleeve.
 - 2. Ductile iron with standard pattern mechanical joint or push on joint fittings
 - 3. PVC Schedule 40 with solvent weld fittings.
- F. Aboveground domestic water piping, NPS 6 and smaller, shall be the following:
 - 1. Hard copper tube, ASTM B 88, Type L (ASTM B 88M, Type B); wrought-copper, solderjoint fittings; and soldered joints.

3.15 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

- 1. Shutoff Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
- 2. Throttling Duty: Use ball valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
- 3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
- 4. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

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SECTION 230500 - COMMON WORK RESULTS FOR MECHANICAL

PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS:
 - A. All drawings associated with the entire project, including general provisions of the Contract, including The General Conditions of the Contract for Construction, General and Supplementary Conditions and Division-1 Conditions specification sections shall apply to the Division 21, 22, and 23 specifications and drawings. The Contractor shall be responsible for reviewing and becoming familiar with the aforementioned and all other Contract Documents associated with the project.
 - B. Related Sections: Refer to all sections in Division 21, 22, and 23. Refer to Division 26 specification sections and Division 26 drawings.
 - C. Where contradictions occur between this section and Division 1, the more stringent requirement shall apply.
 - D. Contractor shall be defined as any and all entities involved with the construction of the project.

1.2 SUMMARY:

- A. This Section specifies the basic requirements for mechanical installations and includes requirements common to more than one section of Divisions 21, 22, and 23. It expands and supplements the requirements specified in Division 1.
- 1.3 MECHANICAL INSTALLATIONS:
 - A. The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the mechanical work and its interface with all other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.
 - B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. Report any discrepancies to the Engineer and obtain written instructions before proceeding. Where any contradictions occur between the specifications and the drawings the more stringent requirement shall apply. The contractor shall include pricing for the more stringent and expensive requirements.
 - C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, Contractor shall take the necessary measurements and prepare the drawings.
 - D. The exact location for some items in this specification may not be shown on the drawings. The location of such items may be established by the Engineer during the progress of the work.
 - E. The contract documents indicate required size and points of terminations of pipes, and suggest proper routes to conform to structure, avoid obstructions and preserve clearances. It is not intended that drawings indicate necessary offsets. The contractor shall make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear, without further instructions or costs to the Owner. All equipment shall be installed so access is maintained for serviceability.

- F. Before any work is installed, determine that equipment will properly fit the space; that required piping grades can be maintained and that ductwork can be run as intended without interferences between systems, structural elements or work of other trades.
- G. Verify all dimensions by field measurements.
- H. Coordinate installation in chases, slots and openings with all other building components to allow for proper mechanical installations.
- I. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- J. Where mounting heights are not detailed or dimensioned, install mechanical services and overhead equipment to provide the maximum headroom possible.
- K. Install mechanical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- L. Make allowance for expansion and contraction for all building components and piping systems that are subject to such.
- M. The ceiling space shall not be "layered". It is the contractor's responsibility to offset the system as required to allow installation within the identified ceiling cavity. The contractor shall include labor and material in the base bid to accommodate such offsets.
- N. In general, all "static" piping systems shall be routed as high as possible, i.e. fire protection systems. Keep all equipment in accessible areas such as corridors and coordinate with systems and equipment from other sections.
- O. The Contractor shall provide all labor and material necessary but not limited to the starting/stopping of all mechanical equipment, opening/closing of all valves, draining/refilling all mechanical systems and operating/verifying the operation of all mechanical systems controls as required to accomplish all work necessary to meet construction document requirements. Contractor shall submit records of such activities to engineer and include in the O & M manuals.

1.4 COORDINATION:

- A. Work out all installation conditions in advance of installation. The Contractor shall be responsible for coordination of all work, in all areas. The Contractor shall be responsible for providing all labor and material, including but not limited to all fittings, isolation valves, offsets, hangers, control devices, etc., necessary to overcome congested conditions at no increase in contact sum. The Contractors base bid shall include any and all time and manpower necessary to develop such coordination efforts. Increases to contract sum or schedule shall not be considered for such effort.
- B. Provide proper documentation of equipment, product data and shop drawings to all entities involved in the project. Coordination shall include, but not be limited to the following:
 - 1. Fire Protection and Fire Alarm Contractor shall provide shop drawings to all other Division 21, 22, and 23 Contractors.
 - 2. Automatic Temperature Controls, Building Management and Testing, Adjusting and Balancing Contractors shall be provided with equipment product data and shop drawings

from other Division 21, 22, 23 and 26 Contractors and shall furnish the same information involving control devices to the appropriate Division 21, 22, and 23 Contractor.

- 3. Furnish building equipment (elevator, food service, medical, technology, etc) information to Div 21, 22, and 23 contractors.
- C. Coordination Drawings:
 - 1. Contractor is responsible for preparing coordination drawings as specified here in. Coordination drawings shall be prepared by the Contractor for his utilization and are his responsibility to assure systems will be installed in a manner to allow all systems to function properly.
 - 2. Submit drawings for all areas, pay special attention to those places where clearances are limited, where space problems exist, for places where several elements of work (or combinations of mechanical and other work) must be located with precision in order to fit into available space, where sequencing is of importance to the efficient flow of work and as specified, and required.
 - 3. Coordination drawings are informational submittals. Submit coordination drawings to Engineer for information only to document proper coordination of all portions of work and that coordination issues have been identified and resolved prior to submitting to the Engineer and prior to commencing construction in each affected area. The review of the coordination drawings by the Engineer does not constitute a relief of responsibility of the Contractor or a change to the contract documents. The Contractor shall have sole responsibility in developing a fully coordinated and integrated ceiling cavity.
 - 4. The Contractor shall take the lead in coordinating and drawing Division 26 and other Division 21, 22, and 23 components such as fire protection, plumbing, piping, sheet metal, etc. Where appropriate, the Contractor shall include medical gas, conduit, cable trays, pneumatic tube and any other system which may occupy the ceiling cavity.
 - 5. Clearly indicate solutions to space problems. Identification of space problems without solutions is not acceptable. Only areas clearly identified will be reviewed.
 - 6. All coordination drawings shall be 3D, with provision for collision check. The contractor is responsible for obtaining the architectural and structural files in 3D, if not available, the contractor shall develop them from the 2D architectural and structural drawings. All 3D drawing development, collision check, coordination, etc. shall be included as part of the Contractors base bid.
 - 7. Prepare Coordination Drawings and other Shop Drawings at a suitable scale, showing the required dimensions. In addition to the mentioned areas and systems above, also submit the following:
 - a. All mechanical equipment rooms such as fan rooms, boiler rooms, fire protection system rooms, etc. (1/4"=1'-0" scale).
 - b. All building floor plans (1/8"=1'-0" scale). Include all shafts with clearances.
 - c. Air handling unit, etc. main duct connections and transitions in ceiling space and to shafts or horizontal ducts. (1/4"=1'-0").
 - d. Required access for all equipment requiring code or maintenance access.
 - e. All sections and elevations necessary for clarification.
 - f. Indicate all seismic restraint and support systems to be used for all mechanical equipment throughout the project.
 - g. Indicate duct and pipe elevations. Indicate clearances for installing and maintaining insulation.
 - h. Servicing and maintaining equipment, valve stem movement, and similar requirements.
 - i. Indicate movement and positioning of large equipment into the building during construction. Indicate pipe and duct size. Indicate equipment tags.
 - 8. CADD Drawings: Electronic mechanical AutoCAD drawings are available from the Architect after proper request have been made and liability release forms executed.

Contact Engineer for further information in acquiring CADD drawings. The Engineers Construction documents cannot be used directly for coordination drawings. They are for information and initial coordination only.

- D. Existing Conditions:
 - 1. Carefully survey existing conditions prior to bidding work. In addition, Contractor shall complete a thorough ceiling cavity survey prior to developing 3D drawing.
 - 2. Contractor shall be responsible for showing all existing conditions on the 3D coordination drawings.
 - 3. Provide proper coordination of mechanical work with existing conditions.
 - 4. Report any issues or conflicts immediately to Engineer before commencing with work and prior to purchasing equipment and materials.
- 1.5 COORDINATION WITH OTHER DIVISIONS:
 - A. General:
 - 1. Coordinate all work to conform to the progress of the work of other trades.
 - 2. Complete the entire installation as soon as the condition of the building will permit. No extras will be allowed for corrections of ill-timed work, when such corrections are required for proper installation of other work.
 - B. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electrical systems within the cavity space allocation in the following order of priority:
 - 1. Equipment and required clearances
 - 2. Plumbing waste, cooling coil drain piping and roof drain mains and leaders.
 - 3. Pneumatic tube systems.
 - 4. Ductwork mains
 - 5. Plumbing vent piping
 - 6. Medgas/lab gas systems
 - 7. Low pressure ductwork and air devices.
 - 8. Electrical and communication conduits, raceways and cabletray.
 - 9. Domestic hot and cold water
 - 10. Hydronic piping
 - 11. Fire sprinkler mains, branch piping and drops (locate as tight to structure as possible).
 - 12. DDC control wiring and other low voltage systems.
 - 13. Fire alarm systems.
 - C. Chases, Inserts and Openings:
 - 1. Provide measurements, drawings and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
 - 2. Check sizes and locations of openings provided. Including the access panels for equipment in hard lid ceilings and wall cavities.
 - 3. Any cutting and patching made necessary by failure to provide measurements, drawings and layouts at the proper time shall be done at no additional cost in contract sum.
 - D. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.

- E. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- F. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials. Refer to Division 1 and Division 23.
- G. Modifications required as result of failure to resolve interferences, provide correct coordination drawings or call attentions to changes required in other work as result of modifications shall be paid for by responsible Contractor/Subcontractor.
- H. Coordination with Electrical Work: Refer to Division 1 and 26.
- 1.6 DESIGN WORK REQUIRED BY CONTRACTOR:
 - A. The construction of this project requires the Contractor to include the detailing and design of several systems and/or subsystems. All such design work associated with the development of coordination drawings shall be the complete responsibility of the Contractor.
 - B. The Contractor shall take the full responsibility to develop and complete routing strategies which will allow fully coordinated system to be installed in a fully functional manner. The Engineers contract drawings shall be for system design intent and general configurations.
 - C. Systems or subsystems which require design responsibility by the contractor include but are not limited to:
 - 1. Final coordinated distribution of duct, hydronic, plumbing and other systems within the ceiling cavity.
 - 2. Any system not fully detailed
 - 3. Fire protection systems
 - 4. Equipment supports, hangers, anchors and seismic systems not fully detailed nor specified in these documents, or catalogued by the manufacturer.
 - 5. Temperature controls systems
 - 6. Refrigeration systems
 - 7. Seismic restraint systems
 - D. Design Limitations:
 - 1. The Contractor shall not modify the Engineers design intent in any way.
 - 2. The Contractor shall not change any pipe size or equipment size without prior written approval from the Engineer.
 - 3. The Contractor shall conform to the SMACNA Duct Construction Standards when modifying the ductwork layout to avoid collisions.
 - 4. Back to back 90° fittings on duct system shall not be installed under any circumstance.
 - 5. Bull nosed tees on piping systems shall not be installed under any circumstance.
 - 6. Internal tie rods shall not be used. Brace duct externally.
- 1.7 PROJECT CONDITIONS:
 - A. The Contractor shall be required to attend a mandatory pre-bid walk-thru and shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for existing conditions.
 - B. Field verify all conditions prior to submitting bids.

- C. Report any damaged equipment or systems to the Owner prior to any work.
- D. Protect all mechanical and electrical work against theft, injury or damage from all causes until it has been tested and accepted.
- E. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the work which may show defect during one year from the final acceptance of all work, provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.
- F. The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections, system shutdowns and start-ups, flushing and filling both new and existing systems.
- G. Provide temporary ductwork and piping services, where required, to maintain existing areas operable.
- H. Coordinate all services shut-down with the Owner; provide temporary services. Coordinate any required disruptions with Owner, one week in advance.
- I. Minimize disruptions to operation of mechanical systems in occupied areas.
- 1.8 SAFETY:
 - A. Refer to Division 1.
- 1.9 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS:
 - A. Refer to Division 1 and conform with the Owners requirements.
- 1.10 REQUIREMENTS OF REGULATORY AGENCIES:
 - A. Refer to Division 1.
 - B. Execute and inspect all work in accordance with all Underwriters, local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the greater requirement shall be followed. Follow recommendations of NFPA, SMACNA, EPA, OSHA and ASHRAE.
 - C. Comply with the local and state codes adopted by the Authorities Having Jurisdictions at the time of permit application, including referenced standards, amendments and policies. See code declaration information on the drawings.
 - D. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
 - E. The handling, removal and disposal of regulated refrigerants and other materials shall be in accordance with U.S. EPA, state and local regulations.
 - F. The handling, removal and disposal of lead based paint and other lead containing materials shall comply with EPA, OSHA, and any other Federal, State, or local regulations.

G. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.

1.11 REQUIREMENTS OF LOCAL UTILITY COMPANIES:

- A. Comply with rules and regulations of local utility companies. Include in bid the cost of all valves, valve boxes, meter boxes, meters and such accessory equipment which will be required but not provided by Local Utility Company for the project.
- B. Utility Connections:
 - 1. 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. Provide required connection for each service.
 - 2. The contract documents indicate the available information on existing utilities and services and on new services (if any) to be provided to the project by utility companies and agencies. Notify Engineer immediately if discrepancies are found.
 - 3. Coordinate mechanical utility interruptions one week in advance with the Owner and the Utility Company. Plan work so that duration of the interruption is kept to a minimum.

1.12 PERMITS AND FEES:

- A. Refer to Division 1.
- B. The Contractor shall pay all tap, development, meter, etc., fees required for connection to municipal and public utility facilities, unless directed otherwise by the General Contractor/Owner – IN WRITING.
- C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.
- 1.13 PROJECT SEISMIC REQUIREMENTS:
 - A. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
 - B. All systems shall be installed to meet NFPA and IBC Seismic requirements.
 - 1. Where any conflicts arise the more stringent requirements shall be applicable.
 - 2. The design of the seismic requirements shall be the full responsibility of the Contractor.

1.14 TEMPORARY FACILITIES:

- A. Light, Heat, Power, Etc.: Responsibility for providing temporary electricity, heat and other facilities shall be as specified in Division 1.
- B. Use of Permanent Building Equipment for Temporary Heating or Cooling: Permanent building equipment shall not be used without written permission from the Owner. If this equipment is used for temporary heating or cooling, it shall be adequately maintained per manufacturer's instructions and protected with filters, strainers, controls, reliefs, etc. Steam and hydronic systems shall be flushed and chemically treated. Ductwork and air moving equipment shall be cleaned to an "AS New" condition. All filters required for the construction period shall be equivalent to the filters required for the final installation. All filters shall be replaced at the time

of substantial completion. The guarantee period of all equipment used shall not start until the equipment is turned over to the Owner for his use. A written record of maintenance, operation and servicing shall be turned over to the owner prior to final acceptance.

- 1.15 PRODUCT OPTIONS AND SUBSTITUTIONS:
 - A. Refer to the Instructions to Bidders and Division 1.
 - B. The burden of proof that proposed equipment is equal in size, capacity, performance, and other pertinent criteria for this specific installation, or superior to that specified is up to the Contractor. If substitutions are not granted, the specified materials and equipment must be installed. Where substituted equipment is allowed, it shall be the Contractor's responsibility to notify all related trades of the accepted substitution and to assume full responsibility for all costs caused as a result of the substitution.
 - C. Materials and equipment of equivalent quality shall be submitted for substitution prior to bidding. This may be done by submitting to the Architect/Engineer at least ten (10) working days prior to the bid date requesting prior review. This submittal shall include all data necessary for complete evaluation of the product.
 - 1. Substitutions shall be allowed <u>only</u> upon the written approval of the Architect/Engineer NO EXCEPTIONS.
 - 2. The Contractor shall be responsible for removal, replacement and remedy of any system or equipment which has been installed which does not meet the specifications and scheduled performance or which does not have prior approval.
 - D. Bidders opting to bid or propose comparable products (either a product by a listed acceptable manufacturer in the respective specification section or a substitution request) are responsible for:
 - 1. Confirming the equipment they are bidding will fit in the space available, incorporating equipment's clearance requirements.
 - 2. Coordination of any variance from basis-of-design in weight, electrical requirements, other utility requirements, etc. with other trades.
 - 3. Inclusion in the bid of any applicable costs for changes in prime bidder's and their sub bidders' work required to accommodate the utilization of the comparable product.
 - 4. The contractor shall bear any and all responsibility including any changes to mechanical, plumbing, electrical, structural or architectural design. These changes shall be clearly identified and presented to the Design Team.

1.16 MECHANICAL SUBMITTALS:

- A. General
 - 1. Refer to the Conditions of the Contract (General and Supplementary), Division 1.
 - 2. Contractor shall provide a submittal schedule appropriate for the size and schedule of the project. Limit the number of large submittals being reviewed at one time and coordinate timing of sections that are dependent on each other.
 - 3. The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
 - 4. The front of each submittal package shall be identified with the specification section number, job name, Owner's project number, date, Prime Contractor and Sub-Contractor's names, addresses, and contact information, etc. Each Specification Section shall be
submitted individually and submittal shall be tabbed for the equipment/materials/etc. within the section. Submittals that are not complete with the required information will not be reviewed and will be sent back to be corrected.

- 5. Submittals shall be provided electronically. All electronic submittals need to be complete with all design information and stamped for conformity by the contractor. Submittals will be reviewed, marked appropriately and returned by the same means received.
- 6. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)
 - c. Specification Section
 - d. Manufacturer and Model Number
- 7. Submittal schedule shall be provided for review within four (4) working weeks from award of contract to successful bidder or as required by Division 1.
- B. Basis of Design: The manufacturer's material or equipment listed in the schedule or identified by name on the drawings are the basis of design and provided for the establishment of size, capacity, grade and quality. If the contractor proposes alternates or substitutions in lieu of the scheduled names, the cost of any changes in construction required by their use shall be borne by Contractor.
- C. All equipment shall conform to the State and/or local Energy Conservation Standards.
- D. Contractor Review: Submittal of shop drawings, product data and samples will be accepted only when submitted by and stamped by the General Contractor. Each submittal shall be reviewed by the contractor for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Any submittal not stamped or complete will be sent back. Data submitted from Subcontractors and material suppliers directly to the Engineer will not be processed unless prior written approval is obtained by the Contractor.
- E. Submittal Review Process: Before starting work, prepare and submit to the Architect/Engineer shop drawings and descriptive equipment data required for the project. Continue to submit in the stated format after each Architect/Engineer's action until a "No Exception Taken" or "Make Correction Noted" action is received. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the Operating and Maintenance Manual (O&M). Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer may summarize comments in letter format and return the entire set. Submittals shall be prepared per the MECHANICAL SUBMITTAL CHECKLIST, at the end of this section; supplemental requirements are listed in each Division 21, 22, and 23 Sections.
- F. The Design Professional's review and appropriate action on all submittals and shop drawings is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include:
 - 1. Accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes
 - 2. Construction means or methods
 - 3. Coordination of the work with other trades
 - 4. Construction safety precautions

- G. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component.
- H. The Design Professional shall not be responsible for any deviations from the contract documents not brought specifically to the attention of the Design Professional in writing by the Contractor. This shall clearly identify the design and the specific element which vary from the Design. The Contractor shall be responsible for all remedy for lack of strict conformance associated with this criteria.
- I. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
- J. If more than two submittals (either for product data, shop drawings, record drawings, or test and balance reports) are made by the Contractor, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.
- K. The contractor shall cloud all changes made on submittals that are marked "Revise and Resubmit."
- L. Required Submittals: Provide submittals for each item of equipment specified or scheduled in the contract documents. See table at the end of this section.
- 1.17 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:
 - A. Product Listing:
 - 1. Prepare listing of major mechanical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect. A sample schedule is included at the end of this section to complete this requirement.
 - a. Provide all information requested.
 - b. Submit this listing as a part of the submittal requirement specified in Division 1, "PRODUCTS AND SUBSTITUTION."
 - 2. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.
 - 3. When two or more items of same material or equipment are required (plumbing fixtures, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, pipe, tube, fittings (except flanged and grooved types), sheet metal, wire, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units and similar items used in work, except as otherwise indicated.
 - a. Provide products which are compatible within systems and other connected items.
 - B. Schedule of Values
 - 1. Provide preliminary schedule of values with product data submittal, within three (3) weeks from award of contract to successful bidder. Provide according to the following descriptions:
 - a. Site Utilities

- b. Plumbing
 - 1) Underground rough-in
 - 2) Aboveground rough-in
 - 3) Fixtures
 - 4) Insulation
 - 5) Aboveground finish
 - 6) Fixture set
 - 7) Insulation
- c. Fire Protection
- d. HVAC
 - 1) Equipment
 - 2) Sheet Metal
 - 3) Piping
 - 4) Insulation
 - 5) Test and Balancing
 - 6) Specialty Systems
 - 7) Temperature Controls
- e. Demolition
- f. Miscellaneous
- 2. Provide a final Schedule of Values at close-out of project including updated values based on actual installation.
- C. Product Data:
 - 1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
 - 2. Delete or mark-out portions of pre-printed data which are not applicable.
 - 3. Where operating ranges are shown, mark data to show portion of range required for project application.
 - 4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Piping and electrical connection sizes and locations.
 - f. Statements of compliance with the required standards and regulations.
 - g. Performance data.
 - h. Manufacturer's specifications.
- D. Shop Drawings:
 - 1. Shop Drawings are defined as mechanical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
 - 2. Prepare Mechanical Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", unless otherwise noted.
 - a. Show clearance dimensions at critical locations.

- b. Show dimensions of spaces required for operation and maintenance.
- c. Show interfaces with other work, including structural support.
- E. Coordination Drawings: See separate paragraph of this specification section.
- F. Test Reports:
 - 1. Submit test reports which have been signed and dated by the accredited firm or testing agency performing the test.
 - 2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
 - 3. Submit test reports as required for O & M manuals.
- G. Operation and Maintenance Data: See separate paragraph of this specification section.
- H. Software Licenses: Provide documentation of ownership under the owner's corporate name (coordinate with owner's representative for exact ownership wording) for Software Licenses provided as part of the work. Include information for updates, subscription requirements if applicable, backup, support, login, passwords, date when purchased, expiration date if applicable, version, etc. Include in the O & M Manual after review and "No Exceptions Taken" has been accomplished.
- I. Record Drawings: See separate paragraph of this specification section.
- 1.18 DELIVERY, STORAGE, AND HANDLING:
 - A. Refer to Division 1 Sections on Transportation and Handling and Storage and Protection.
 - B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels and similar information needed for distinct identifications; adequately packaged and protected to prevent damage or contamination during shipment, storage, and handling.
 - C. Check delivered equipment against contract documents and submittals.
 - D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage, dirt, dust, freezing, heat and moisture.
 - E. Coordinate deliveries of mechanical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.
 - F. Provide factory-applied plastic end-caps on each length of pipe and tube. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris and moisture.
 - G. Protect stored ductwork, pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.
 - H. Protect flanges, fittings and specialties from moisture and dirt by inside storage and enclosure, or be packaging with durable, waterproof wrapping.
 - I. Protect sheet metal ductwork and fittings. Elevate and store above grade and cover ends with waterproof wrapping.

1.19 DEMOLITION:

- A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
- B. During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, piping or ductwork and related items either as shown on the demolition drawings as being removed, or as required for the work. These items shall be tagged, protected from damage and stored as directed by the Owner. A list of all items stored shall be turned over to the Architect/Engineer. At the completion of the remodeling work or when directed by the Architect, all stored items not reused or wanted by the Owner shall be removed from the premises.
 - 1. Return existing thermostats to the owner.
 - 2. Return all demolished control valves and devices to the Owner.
- C. The location of existing equipment, pipes, ductwork, etc., shown on the drawings has been taken from existing drawings and is, therefore, only as accurate as that information. All existing conditions shall be verified from field measurements with necessary adjustment being made to the drawing information.
- D. Hazardous Material: If suspected hazardous material, in any form, is discovered by this Contractor in the process of his work, he shall report such occurrence to the Owner immediately. The Owner will determine the action to be taken for the hazardous material removal, which is not a part of the work to be done under this Division.

1.20 CUTTING AND PATCHING: EDIT NOTE: DELETE ITEMS SPECIFIC TO DEMO IF NONE

- A. This Article specifies the cutting and patching of mechanical equipment, components and materials to include removal and legal disposal of selected materials, components and equipment. Coordinate the cutting and patching of building components to accommodate the installation of mechanical equipment and materials.
- B. Refer to Division 1.
- C. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of mechanical installations.
- E. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective or non-conforming installations.
- F. Perform cutting, fitting and patching of mechanical equipment and materials required to:
 - 1. Uncover work to provide for installation of ill-timed work;
 - 2. Remove and replace defective work;
 - 3. Remove and replace work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed work as specified for testing;
 - 5. Install equipment and materials in existing structures;
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore work to provide for Architect /Engineer observation of concealed work.

- G. Cut, remove and legally dispose of selected mechanical equipment, components, and materials as indicated, including, but not limited to removal of mechanical piping, heating units, and other mechanical items made obsolete by the new work.
- H. Protect the structure, furnishings, finishes and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain an approved type of temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas. Temporary partitions must not impede access to building egress.
- J. Locate identify, and protect mechanical and electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When services must be interrupted, provide temporary services for the affected areas and notify the Owner prior to changeover. Cover openings in ductwork to remain. Protect equipment and systems to remain.
- 1.21 ROUGH-IN:
 - A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough-in requirements.
 - C. Work through all coordination before rough-in begins.
- 1.22 ACCESSIBILITY:
 - A. Install equipment and materials to provide required access for servicing and maintenance. Coordinate the final location of concealed equipment and devices requiring access with final location of required access panels and doors. Allow ample space for removal of all parts that require replacement or servicing.
 - B. Extend all grease fittings to an accessible location.
 - C. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, fans, balancing cocks, and other operating devices requiring adjustment or servicing. Refer to Division 8 for access door specification and Division 23 for duct access door requirements.
 - D. The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.
 - E. Furnish doors to trades performing work in which they are to be built, in ample time for building-in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.
 - F. Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed. In lieu of these doors, approved shop fabricated access doors with DuroDyne hinges may be used.
 - G. Access doors in fire-rated walls and ceilings shall have equivalent U.L. label and fire rating.

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- H. Final installed conditions shall accommodate accessibility and replacement of system components that regularly require service and replacement. This includes control devices, sensors, motors, etc.. Such devices shall not be permanently obstructed by building systems such as piping, ductwork, insulation, drywall, etc.
- 1.23 BELTS, SHEAVES, IMPELLERS:
 - A. The Mechanical Contractor shall coordinate with the Test and Balance Contractor and supply correctly-sized drive belts, sheaves, and trimmed impellers.
- 1.24 EXCAVATING AND BACKFILLING:
 - A. General:
 - 1. Provide all necessary excavation and backfill for installation of mechanical work in accordance with Division 2.
 - In general, follow all regulations of OSHA as specified in Part 1926, Subpart P, "Excavations, Trenching and Shoring." Follow specifications of Division 23 as they refer specifically to the mechanical work.
 - B. Contact Owners of all underground utilities to have them located and marked, at least 2 business days before excavation is to begin. Also, prior to starting excavation brief employees on marking and color codes and train employees on excavation and safety procedures for natural gas lines. When excavation approaches gas lines, expose lines by carefully probing and hand digging.
 - C. Pipe Trenching:
 - 1. Provide all necessary pumping, cribbing and shoring.
 - 2. Walls of all trenches shall be a minimum of 6 inches clearance from the side of the nearest mechanical work. Install pipes with a minimum of 6 inches clearance between them when located in same trench.
 - 3. Dig trenches to depth, width, configuration, and grade appropriate to the piping being installed. Dig trenches to 6inches below the level of the bottom of the pipe to be installed. Install 6 inches bed of pea gravel or squeegee, mechanically tamp to provide a firm bed for piping, true to line and grade without irregularity. Provide depressions only at hubs, couplings, flanges, or other normal pipe protrusions.
 - D. Backfilling shall not be started until all work has been inspected, tested and accepted. All backfill material shall be reviewed by the soils engineer. In no case shall lumber, metal or other debris be buried in with backfill.
 - 1. Provide warning tape for marking and locating underground utilities. Tape shall be specifically manufactured for this purpose and shall be polyethylene film, 6 inches wide, 0.004 inches thick and have a minimum strength of 1750 psi. Tape shall carry continuous inscription naming the specific utility.
 - a. Tape shall have magnetic strip and be used for exterior underground system only.

- E. Trench Backfill:
 - 1. Backfill to 12 inches above top of piping with pea gravel or squeegee, the same as used for piping bed, compact properly.
 - 2. Continue backfill to finish grade, using friable material free of rock and other debris. Install in 6 inch layers, each properly moistened and mechanically compacted prior to installation of ensuing layer. Compaction by hydraulic jetting is not permissible.
- F. After backfilling and compacting, any settling shall be refilled, tamped, and refinished at this contractor's expense.
- G. This contractor shall repair and pay for any damage to finished surfaces.
- H. Complete the backfilling near manholes using pea gravel or squeegee, installing it in 6 inch lifts and mechanically tamping to achieve 95 percent compaction.
- Use suitable excavated material to complete the backfill, installed in 6 inch lifts and mechanically compacted to seal against water infiltration. Compact to 95 percent for the upper, 30 inches below paving and slabs and 90 percent elsewhere.

1.25 NAMEPLATE DATA:

- A. Provide permanent operational data nameplate, refer to the section on Mechanical Identification, on each item of mechanical equipment, indicating manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location. Coordinate with Owner for specific requirements.
- 1.26 LUBRICATION OF EQUIPMENT:
 - A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
 - B. Contractor shall properly lubricate all mechanical pieces of equipment which he provided before turning the building over to the Owner. He shall attach a linen tag or heavy duty shipping tag on the piece of equipment showing the date of lubrication and the type and brand of lubricant used.
 - C. Furnish the Engineer with a typewritten list included in the O&M manuals of each item lubricated and type of lubricant used, no later than two (2) weeks before completion of the project, or at time of acceptance by the Owner of a portion of the building and the mechanical systems involved.
- 1.27 CLEANING:
 - A. Refer to Division 1.
 - B. Refer to Division 23, "TESTING, ADJUSTING AND BALANCING" for requirements for cleaning filters, strainers, and mechanical systems prior to final acceptance.
- 1.28 RECORD DOCUMENTS:
 - A. Refer to Division 1. The following paragraphs supplement the requirements of Division 1.
 - B. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.

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- C. Mark Drawing Prints to indicate revisions to piping and ductwork, size and location both exterior and interior; including locations of coils, dampers and other control devices, filters, boxes, and similar units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned to column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (i.e., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices. Changes to be noted on the drawings shall include final location of any piping or ductwork relocated more than 1foot-0inches from where shown on the drawings.
- D. Mark shop drawings to indicate approved substitutions; Change Orders; actual equipment and materials used.
- E. Mark equipment and fixture schedules on drawings to indicate manufacturer and model numbers of installed equipment and fixtures.
- F. Reference to change order numbers, RFIs, etc., are not acceptable as-builts.
- G. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme:
 - 1. Red shall indicate new items, deviations and routing.
 - 2. Green shall indicate items removed or deleted.
 - 3. Blue shall be used for relevant notes and descriptions.
- H. At the completion of the project, obtain from the Architect a complete set of the Mechanical Contract Documents in a read-only electronic format (.pdf unless otherwise noted). This set will include all revisions officially documented through the Architect/Engineer. Using the above color scheme, transfer any undocumented revisions from the construction site record drawings to this complete set. Submit completed documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.
- I. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up .pdf format readable by Bluebeam is preferred.
- 1.29 OPERATION AND MAINTENANCE DATA:
 - A. Refer to Division 1.
 - B. No later than four (4) weeks prior to the completion of the project provide one complete set of Operating and Maintenance Manuals, or as specified in Sections of Division 1 (whichever is more stringent).
 - C. The testing and balancing report shall be submitted and received by the Engineer at least fifteen calendar days prior to the contractor's request for final observation time frame requirements. Include in the O & M Manual after review with "No Exceptions Taken" has been accomplished.
 - D. In addition to the information required by Division 1 for Maintenance Data, include the following information:
 - 1. The job name and address and contractor's name and address shall be identified at the front of the electronic submittal.

- 2. Description of mechanical equipment, function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
- 3. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions. Provide any test reports and start-up documents.
- 4. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
- 5. Servicing instructions, lubrication charts and schedules, including Contractor lubrication reports.
- 6. Manufacturer's service manuals for all mechanical equipment provided under this contract.
- 7. Include the valve tag list.
- 8. Name, Address and Telephone numbers of the Sub-contractors and local company and party to be contacted for 24-hour service and maintenance for each item of equipment.
- 9. Starting, stopping, lubrication, equipment identification numbers and adjustment clearly indicated for each piece of equipment.
- 10. Complete recommended spare parts list.
- 11. Mechanical System and Equipment Warranties.
- 12. Copies of all test reports shall be included in the manuals.
- 13. Provide manuals with dividers for major sections and special equipment. Mark the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
- 14. Final schedule of values with all mechanical change order costs included and identified.
- 15. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up PDF format readable by Bluebeam is preferred.
- E. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, and final Schedule of Values with all Electrical and Information Technology change order costs included and identified is provided and the manual is reviewed by the Architect/Engineer.
- 1.30 PROJECT CLOSEOUT LIST:
 - A. In addition to the requirements specified in Division 1, complete the requirements listed below.
 - B. The Contractor shall be responsible for the following Mechanical Submittal Checklist either by performing and/or coordinating such items prior to applying for certification of substantial completion. Refer to individual specification sections for additional requirements. (Checklist is located at the end of this section.)

1.31 WARRANTIES:

- A. Refer to the Division 1 for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In any case the entire mechanical system shall be warranted no less than one year from the time of acceptance by the Owner.
- B. Compile and assemble the warranties specified in Division 21, 22, and 23, into the Operating and Maintenance Manuals.
- C. Provide complete warranty information for each item to include product or equipment to include date or beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.32 CONSTRUCTION REQUIREMENTS:

- A. The contractor shall maintain and have available at the jobsite current information on the following at all times:
 - 1. Up to date record drawings.
 - 2. Submittals
 - 3. Site observation reports with current status of all action items.
 - 4. Test results; including recorded values, procedures, and other findings.
 - 5. Outage information.

1.33 EQUIPMENT HOUSEKEEPING PADS:

- A. Provide 3-1/2" concrete housekeeping pad for all floor mounted equipment including, but not limited to: air compressors, air handling units, boilers, chillers, condensing units, cooling towers, deaerators, fans, furnaces, medical gas equipment, processed water systems pumps, storage tanks, water heaters, and water treatment systems. Fabricate pads as follows:
 - 1. Coordinate size of equipment bases with actual unit sizes provided. Fabricate base 4" larger in both directions than the overall dimensions of the supported unit.
 - 2. Form concrete pads with framing lumber with form release compounds. Chamfer top edge and corners of pad.
 - 3. Place concrete and allow to cure before installation of units. Use Portland cement that conforms to ASTM C 150, 4000-psi compressive strength, and normal weight aggregate.
 - 4. Anchor housekeeping pads to slab using #3 rebar bent in "L" or "Z" shape 12 inch on center on each side of slab.

	Item	Requirements							
0		Submittals			Supplemental		Factory	Training	Extra
Spec Section		Shop Drawings	Product Data	Include In O & M	Test ³	Report ³	Rep Super- Vision At Site	Req'd At Site	Material
230500	Preliminary Schedule Of Values					x			
230500	Final Schedule Of Values			X		x			
230500	Equipment Warranties			X					
230500	O&M Manuals		Х	X		X			Х
230500	Coordination Drawings	Х							
230500	Record Drawings	Х	Х	Х					
230507	Motors, Drives, Motor Controllers	Х	Х	Х					
230509	Mechanical Fire Stopping	х	Х	X				х	
230510	Basic Piping Materials And Methods		х	x	х	x			
230518	Piping Specialties		X	X					
230519	Meters and Gauges		Х	X		X ²			Х
230523	Valves		Х	Х					

1.34 MECHANICAL SUBMITTAL CHECKLIST:

		Requirements							
Creat	Item	Submittals		Supplemental		Factory	Training	Extra	
Spec Section		Shop Drawings	Product Data	Include In O & M	Test ³	Report ³	Rep Super- Vision At Site	Req'd At Site	Material
230529	Hangers and Supports	Х	Х	X					
230548n s	Vibration Control	Х	Х	X	Х	Х			
230553	Mechanical Identification		Х	х					х
230593	Testing, Adjusting and Balancing	Х		Х	Х	Х			
230700	Mechanical Insulation		Х	Х					
230900	Instrumentation and Control for Mechanical	х	х	x		x	x	х	
230993	Sequence Of Operation			X					
232500	Water Treatment	Х	Х	Х	Х	Х		Х	Х
233113	Metal Ducts	Х	X	Х	X	Х			
233300	Air Duct Accessories		Х	Х		Х			Х
233400	HVAC Fans		Х	Х				Х	Х
233713	Diffusers, Registers & Grilles		Х	х					X
Notes:	¹ For Starters and Variable Frequency Drives								
	² Requires Review & Approval of calibrated balance valves from T & B Contractor								
	³ See Specific Specification Section for Test & Certification Requirements								

1.35 MECHANICAL EQUIPMENT CONNECTION SCHEDULES:

- A. Mechanical Equipment:
 - 1. Refer to Mechanical Equipment Schedules on the drawings.
 - 2. All equipment motors and control shall be furnished, set in place, and wired in accordance with the schedule coordinated by the contractor and submitted prior to bid. The exact furnishing and installation of the equipment is left to the Contractors involved and manufacturers installation instructions. Contractor should note that the intent of this schedule is to have the Contractor responsible for coordinating all wiring as outlined, whether or not specifically called for by the Division 23 or Division 26 drawings and specifications. Comply with the applicable requirements of Division 26 for all electrical work which is not otherwise specified. No extras will be allowed for contractor's failure to provide for these required items. Contractor shall refer to the Division 26 and Division 23 specifications and plans for all power and control wiring and shall advise the Architect/Engineer of any discrepancies prior to bidding.

ITEM	FURNISHED	SET	CONTROL
SUBMITTAL TO BE FILLED OUT BY CONTRACTOR	BY	BY	WIRING
PRIOR TO BID			(non-load
			voltage)
1. Mechanical Equipment Motors			<u> </u>

ITEM SUBMITTAL TO BE FILLED OUT BY CONTRACTOR PRIOR TO BID	FURNISHED BY	SET BY	CONTROL WIRING (non-load voltage)
 2. Special Equipment (i.e., elevators, etc.) a. Motors b. Magnetic Motor Starters c. Disconnect Switches d. Thermal OL Switches e. Manual Operating Switches 			
 Motor Starters, combination motor starter/disconnect and Variable Frequency Drives Automatically controlled, with or without HOA switches. Manually controlled. Starters integral with motor control center including control relays and transformers. Combination Starter/Disconnects 			
4. Pushbutton stations, pilot lights			
5. Disconnect switches, thermal overload switches, manual operating switches.			
6. Multi-speed switches			
7. Control relays, transformers.			
8. Non-load voltage control items.			
 Electric thermostats, remote bulb thermostats, motor valves, float controls, etc., which are an integral part of mechanical equipment or directly attached to ducts, pipes, etc. 			
10. Motor valves, damper motor, solenoid valves, EP and PE switches, VAV box controls, actuators, etc.			
11. Control circuit outlets			
a. Load voltage control items such as line voltage thermostats not connected to control panel systems.			
b. Non-load voltage control items.			
c. Electric thermostats, remote bulb thermostats, motor valves, float controls, etc., which are an integral part of mechanical equipment or directly attached to ducts, pipes, etc.			
d. Motor valves, damper motor, solenoid valves, EP and PE switches, VAV box controls, actuators, etc.			
e. Control circuit outlets			
 Electric thermostats, remote bulb thermostats, motor valves, float controls, etc., which are an integral part of mechanical equipment or directly attached to ducts, pipes, etc. 			

ITEM SUBMITTAL TO BE FILLED OUT BY CONTRACTOR PRIOR TO BID	FURNISHED BY	SET BY	CONTROL WIRING (non-load voltage)
13. Fire protection controls (Including flow switches)			
14. Duct smoke detectors, including relays for fan shutdown.			
15. Temperature Control Panel			
16. Interlocks			

G = General, Division 13 or 14

M = Mechanical, Division 23

E = Electrical, Division 26

V = Vendor or Factory – Installed wiring

END OF SECTION 23 05 00

SECTION 230509 - MECHANICAL FIRE STOPPING

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. Extent of firestopping required by this section is indicated on the drawings and by the requirements of this section. Refer to architectural plans and specifications for additional information.
 - B. Types of firestopping systems specified in this section include:
 - 1. Bare metal pipe
 - 2. Insulated metal pipe
 - 3. Plastic piping
 - 4. Metal conduit
 - 5. Metal duct

1.2 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacturing of firestopping systems for mechanical/electrical penetrations, whose products have been in satisfactory use for not less than 5 years, with published application data for all types of penetrations to be encountered on this job, and with local representation capable of providing training and technical assistance at the job site.
- B. Installer's Qualifications: Personnel installing firestopping systems shall have been specifically trained by the manufacturer in the application of the materials to comply with the listing of the tested assembly.
- C. Codes and Standards: Comply with the applicable codes pertaining to firestopping. Firestopping systems shall be tested and listed in accordance with the following:
 - 1. Underwriter's Laboratory:
 - a. UL 1479 test method for fire tests of through-penetration firestops.
 - b. UL Fire Resistance Directory
 - 2. American Society for Testing and Materials: ASTM E814-88 standard test method for fire tests of through-penetration firestops and ASTM E2174 standard practice for onsite Inspection of fire stop systems.

1.3 SUBMITTALS:

- A. Product Data: Manufacturer's specifications and technical data including the following:
 - 1. Detailed specification of construction and fabrication.
 - 2. Manufacturer's installation instructions.
- B. Shop Drawings: Indicate dimensions, description of materials and finishes, general construction, specific modifications, component connections, anchorage methods, hardware and installation procedures, plus the following specific requirements:

- 1. Details of each proposed assembly, for all types of fire rated construction and penetrating items encountered, identifying intended products and applicable UL System Number, or UL classified devices.
- 2. Manufacture or manufacturer's representative shall provide qualified engineering judgments and drawings relating to non-standard applications as needed.
- C. Installer Qualifications: Submit evidence that the actual personnel installing firestopping have been properly trained by the manufacturer.
- 1.4 DELIVERY, STORAGE AND HANDLING:
 - A. Packing and Shipping:
 - 1. Deliver products in original, unopened packaging with legible manufacturer's identification.
 - 2. Coordinate delivery with scheduled installation date, allow minimum storage at site.
 - B. Storage and Protection: Store materials in a clean, dry ventilated location. Protect from soiling, abuse, moisture and freezing when required. Follow manufacturer's instructions.

1.5 PROJECT CONDITIONS:

- A. Existing Conditions:
 - 1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
 - 2. Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.
- B. Environmental Requirements:
 - 1. Furnish adequate ventilation if using solvent.
 - 2. Furnish forced air ventilation during installation if required by manufacturer.
 - 3. Keep flammable materials away from sparks or flame.
 - 4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.
 - 5. Comply with manufacturing recommendations for temperature and humidity conditions before, during and after installation of firestopping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with the requirements of this specification, provide products by one of the following:
 - 1. 3M, Fire Protection Products
 - 2. Nelson Firestop Products
 - 3. TREMCO Construction Products
 - 4. Metalines
 - 5. Hilti Corporation
 - 6. Specified technologies, Inc. (STI)

2.2 GENERAL:

- A. Provide fire stop systems listed in the UL Fire Resistance Directory. Provide systems with fire resistance "F" ratings equal to the fire resistance rating of the wall or floor assembly for all penetrations. In addition, provide systems with a "T" rating equal to the fire resistance rating of the floor assembly for all floor penetrations not within the cavity of a wall.
- 2.3 ACCESSORIES:
 - A. Provide forming and damming materials and sleeves as required by the firestopping system installation instructions.
- PART 3 EXECUTION

3.1 GENERAL:

- A. Review all project drawings, Owner's records and existing conditions to determine location, rating, and construction of all fire resistive construction.
- B. Coordinate location of penetrations to allow for the maximum and minimum annular space around the penetrating item. Allow a minimum of 1" undisturbed building material between penetrations, or provide a firestopping system listed for multiple penetrations. Penetrating items shall be centered in hole as much as practical, unless firestopping system is listed for point contact between the wall/floor assembly and the penetrating item.
- C. Neatly form, saw cut, hole saw or core drill openings. Size openings to conform with the maximum and minimum annular space requirements of the firestopping system.

3.2 APPLICATION:

- A. The Contractor shall determine the most appropriate firestopping system which complies with these specifications and requirements for systems being installed.
- B. All insulation shall be continued through the penetration. Provide intumescent caulk or collar firestopping systems. Where the insulation thickness specified in Section 23 07 00 exceeds the allowable insulation thickness for the firestopping system, reduce the insulation thickness 6 inches on either side of the penetration. Do not reduce insulation to less than 50 percent of the specified thickness.
- C. Provide collar type firestopping systems where shown on drawings, and for hot piping systems at penetrations where significant thermal movement can be expected, such as near expansion compensation loops or joints.
- D. Provide a firestopping system for ducts penetrating fire resistive construction without fire or fire/smoke dampers.
 - 1. Do not provide firestopping between fire or fire/smoke damper sleeves and the opening.
- E. Anchor wiring not within conduit on each side of a penetration to prevent it from being pulled out of the firestopping system.
- F. See Section 23 05 00 for sleeves. The use of sleeves may affect the rating of the firestopping system. Coordinate use of sleeves with firestopping.

END OF SECTION 230509

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SECTION 230593 - TESTING, ADJUSTING AND BALANCING FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. This section covers testing and balancing of environmental systems described herein and specified under Division 23. The testing and balancing of all environmental systems shall be the responsibility of one Testing, Balancing and Adjusting firm.
 - 1. Test, adjust and balance the following mechanical systems and the mechanical equipment associated with these systems:
 - a. General Systems and Equipment Procedures.
 - b. Air Side Systems and Equipment
 - 1) Supply/Return Air Systems
 - 2) General Exhaust/Supply Fans
 - 3) General Exhaust Systems
 - c. Hydronic Systems and Equipment
 - 1) Hydronic coils
 - d. Control Systems and Equipment
 - 1) General

1.2 QUALIFICATIONS OF CONTRACTOR:

- A. The Mechanical Contractor shall procure the services of an independent testing and balancing agency specializing in the testing, adjusting and balancing of environmental systems to perform the above mentioned work. An independent contractor is defined as an organization that is not engaged in engineering design or is not a division of a mechanical contractor entity, which installs mechanical systems.
- B. The actual fieldwork shall be performed by qualified technicians who are currently certified by the Testing, Adjusting and Balancing Bureau (TABB), the National Environmental Balancing Bureau (NEBB), or the Associated Air Balance Council (AABC) certification agencies.
- C. The Testing & Balancing Contractor shall have a minimum of three years experience in testing and balancing mechanical systems.
- D. The Test & Balance Contractor shall have previous experience in testing and balancing variable air volume laboratory fume hood systems in the last two years. Qualification submission must include a detailed resume describing past project experience in laboratory variable air volume systems, a list of projects, including peoples' names, phone numbers and addresses of references.
- 1.3 APPROVAL OF CONTRACTOR:
 - A. The following firms are preferred contractors to complete the work. Any Testing and Balancing firm desiring to offer their services for this work and who are not listed below, shall submit their qualifications to the Architect, not less than seven (7) working days before the bid date.

Approval or disapproval will be given on each request and this action will be given in writing prior to bidding the work.

- 1. Complete Mechanical Balancing
- 2. JPG Engineering
- 3. Griffith Engineering
- 4. Lawrence H. Finn & Assoc.
- 5. TAB Services, Inc.
- 6. Precision Test & Balance, Inc.
- 7. Certified Balancing & Commissioning
- B. Firms who are not listed, or who have not received prior approval shall not be approved to complete work on this project.
- 1.4 CODES AND STANDARDS:
 - A. ASHRAE: ASHRAE Handbook, Applications Volume, Testing, Adjusting, and Balancing Chapter.
 - B. NEBB: "Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems."
 - C. SMACNA: "HVAC Systems-Testing, Adjusting & Balancing."
- 1.5 PRELIMINARY SUBMITTALS:
 - A. Within ten (10) days of award of the contract the Mechanical Contractor shall submit the name of the Test and Balance Contractor who will be performing the work. The submittal shall include a complete list of all technicians who will be performing the field work and include a photocopy of their current certification by either NEBB, AABC, or TABB certification agencies. Only those technicians included in the submittal shall perform the work. Any personnel or staff used to perform the work without prior approval of the Engineer, who are not included in the submittal, shall be grounds for rejecting the test and balance report and the project in whole.
 - B. Meet all requirements of Section 23 05 00 "Common Work Results for Mechanical" as applicable.
 - C. Submit a list of all instrumentation to be used on an individual project and include calibration dates. Submit calibration curves. If more than one instrument of a similar type is used, a comparison of individual readings should be made. The variation between instrument readings should not exceed plus or minus 5%.
- 1.6 FINAL REPORTS:
 - A. Refer to Division 1 for supplemental requirements.
 - B. The Testing and Balancing Contractor shall submit six (6) bound copies of the final testing and balancing report at least fifteen (15) calendar days prior to substantial completion, unless noted otherwise in Division 1. Report contents shall be per Part 3 of this Section.
 - C. Meet all requirements of Section 23 05 00 "Common Work Results for Mechanical" as applicable.
 - D. If more than two reports are made by the contractor, the Owner reserves the right to charge the contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the contractor.

- 1.7 SEQUENCING AND SCHEDULING:
 - A. Notify Contractor/Engineer/Architect in writing of conditions detrimental to the proper completion of the test and balance work. Provide the Contractor/Architect/Engineer with a copy of the notification.
 - B. Prepare a project schedule. Schedule shall indicate critical path of the balancing process and shall incorporate both requirements of other contractors necessary to meet test and balance commitments and process flow of test and balance work. Coordinate with general and mechanical contractors and insert critical steps into project master schedule.

PART 2 - PRODUCTS

- 2.1 BELTS, SHEAVES, IMPELLERS:
 - A. Refer to specific equipment sections and Section 23 05 00 "Common Work Results for Mechanical" for additional requirements.
 - B. The Testing & Balancing Contractor shall coordinate with the Mechanical Contractor to supply correctly sized drive belts and sheaves. Impellers shall be trimmed or replaced by the mechanical contractor and shall be correctly re-sized and coordinated by the Test and Balancing Contractor per the hydronic systems and equipment portion of this section.
 - C. The Test & Balance Contractor shall determine the fan belt and sheave replacement necessary for final balance condition for specified air quantity when the VFD is operating in the by-pass mode for final field conditions, without placing the motor over its nameplate amp rating.

PART 3 - EXECUTION

3.1 PRELIMINARY PROCEDURES:

- A. Testing and balancing shall not begin until the system has been completed and is in full working order and the following project conditions have been determined suitable for start of work.
 - 1. Preliminary Testing & Balancing Contractor requirements shall be ascertained prior to the commencement of work through a review of the project plans and specifications. In addition, visual observations at the site during construction shall be made to determine the location of required balancing devices, that they are being installed properly, and in an accessible location for the need. Report in writing any deficiencies to the Contractor/Engineer/Architect immediately.
 - 2. Before any air balance work is done, the system shall be checked for duct leakage (obtain pressure test results), assure filters are installed, verify filters are changed if they are dirty, check for correct fan rotation, equipment vibration, and check automatic dampers for proper operation. All volume control dampers and outlets shall be wide open at this time.
 - 3. Before any Hydronic, domestic water or applicable system balancing work is done, the systems shall be checked for plugged strainers, proper pump rotation, proper control valve installation and operation, air locks, proper system static pressure to assure a full system, proper flow meter and check valve installation. All throttling devices and control valves shall be open at this time.
 - 4. Verify systems do not exhibit excessive sound and/or vibration levels. Report in writing any deficiencies to the Contractor/Engineer/Architect immediately.

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3.2 PRELIMINARY PROCEDURES – REMODEL WORK:

A. In remodel area, a complete preliminary test and balance report shall be accomplished prior to any work. Any obvious deficiencies shall be identified at that time. A complete report of all readings, recommendations, etc. shall be submitted to the Engineer.

3.3 GENERAL SYSTEM AND EQUIPMENT PROCEDURES:

- A. Balance all air and water flows at terminals within +10% to -5% of design flow quantities. Notify Contractor/Engineer/Architect in writing of conditions detrimental to the proper completion of the test and balance work. Provide the Contractor/Architect/Engineer with a copy of the notification.
- B. Pressure relationships indicated on drawings shall take priority over air quantities.
- C. Mark equipment settings with paint, including damper control positions, balancing cocks, circuit setters, valve indicators, fan speed control settings and similar controls and devices, to show final settings at completion of test-adjust-balance work.
- D. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes, in a manner recommend by the original installer.
- E. Measure, adjust and report equipment running motor amps and power factor, KW, rated motor amperage, listed motor power factor, voltage, and all nameplate data. Perform these measurements for all equipment operational modes.
- F. Check and adjust equipment belt tensioning.
- G. Check keyway and setscrew tightness. Report any loose screws and notify Mechanical Contractor prior to equipment balancing.
- H. Record and include in report all equipment nameplate data.
- I. Verify that all equipment safety and operating controls are in place, tested, adjusted, and set prior to balancing.
- J. Verify that manufacturer start-up has occurred per specification prior to balancing.
- 3.4 AIR SIDE SYSTEMS AND EQUIPMENT PROCEDURES:
 - A. In addition to the procedures identified under each specific heading below, provide general data required by 3.3 above.
 - B. Filters shall be restricted to increase pressure drop to 50% of span between initial pressure drop and final recommended pressure drop for setting final airflows for fans. Check fan motor amps with clean filters and simulated loaded filters, and report for each piece of equipment. Equipment shall be supplied with clean filters upon completion of balance. Balance and report air quantities.
 - C. Supply/Return Air Systems:
 - 1. Balance and report supply and return diffuser/grille quantities. Air diffusion patterns shall be set as noted on drawings and to minimize objectionable drafts and noise.
 - 2. Provide full pitot traverses in duct mains downstream of supply fans, upstream of return fans, and in each zone duct downstream of a multizone unit. For VAV systems perform these at the system diversity condition (if any). Balance and report air quantities.

- 3. Provide full pitot traverses at each air terminal or duct coil. For VAV systems, perform these at zone maximum air condition. Balance and report air quantities.
- 4. Report design air device inlet or outlet size, actual inlet or outlet size, design and actual velocity through the orifice, for each terminal in the system.
- 5. Balance and report the above measurements in all system operational/modes.
 - a. Minimum outside air and 100% outside air economizer mode.
 - b. VAV maximum zone air condition and system diversity condition.
 - c. Unoccupied mode.
 - d. Two-speed fan, both speeds.
 - e. VFD bypass mode and full system demand.
- 6. Report final adjusted K-factors for all terminal boxes.
- D. General Exhaust/Supply Fans:
 - Adjust CFM to system requirements. For belt drive include sheave and belt exchange to deliver airflow within limits of installed motor horsepower and mechanical stress limits of the fan. Determine the limiting fan tip speed before increasing RPM. Final fan speed setting shall allow for filter loading (as applicable) and shall establish proper duct pressures for operation of zone CFM regulators. For direct drive with speed taps: Set fan speed on tap which most closely approaches design CFM by adjusting the speed control After adjustment, check fans ability to re-start after powering down. Increase setting if required for proper starting.
 - 2. Measure and report static pressures upstream and downstream of all fans.
 - 3. Measure and report fan RPM.
 - 4. Report design fan inlet or outlet size, actual inlet or outlet size, design and actual velocity through the orifice.
- E. General Exhaust Systems:
 - 1. Balance and report exhaust grille quantities. Report objectionable noise.
 - 2. Provide full pitot traverses at each individual exhaust riser and at each exhaust fan. Balance and report.
 - 3. Report design air device inlet or outlet size, actual inlet or outlet size, design, and actual velocity through the orifice, for each terminal in the system.
- F. Hydronic Coils:
 - 1. Balance, measure and report inlet and outlet air temperatures for cooling and/or heating design air quantities.
 - 2. Balance, measure and report coil water flow, inlet and outlet water pressure and temperature.
 - 3. Evaporative cooling coils: Measure and report inlet and outlet wet bulb and dry bulb temperature. Measure and report inlet and outlet pressure.
 - 4. Calculate and report face velocities across chilled water and evaporative cooling coils.

3.5 CONTROL SYSTEMS AND EQUIPMENT:

- A. General:
 - 1. Operate all temperature control systems with the temperature control contractor's representative for proper sequence of operation. Be responsible for calibration of flow measurement devices used as input to the temperature control system. All air system flow measurement stations including VAV terminals shall be calibrated against a Pitot

tube traverse or air diffuser capture hood. Balancing Contractor shall assure accuracy of all flow measurement devices or shall report their failure to be accurate.

- 2. Work with the Controls Contractor to set minimum outside air damper positions.
- 3. Work with the Controls Contractor to optimize VAV duct static pressure, VFD pump hydronic system pressure differential and building pressure.

3.6 REPORT OF WORK:

- A. The Testing and Balancing Contractor shall submit electronic copies of the final testing and balancing report at least fifteen (15) calendar days prior to the Mechanical Contractor's request for final inspection.
- B. A complete reduced set of mechanical contract drawings (showing each system) shall be included in the report with all equipment, flow measuring devices, terminals (outlets, inlets, coils, fan coil units, schedules, etc.) clearly marked and all equipment designated. The test and balance contractor can obtain drawing files from Cator, Ruma, & Associates for development of these drawings.
- C. Data shall be reported per Part 3 of this Section on standard NEBB, TABB, or AABC forms. Generate custom forms that contain the information in this Section when a standard form does not exist for a piece of equipment. All forms shall be fully filled out for this report. When additional information is required by this Section, it shall be provided.
- D. The report shall include a list of all equipment used in the testing and balancing work.
- E. Substantial completion of this project will not take place until a satisfactory report is received. The Testing & Balancing Contractor shall respond and correct all deficiencies within seven (7) days of receiving the Engineer's written review of the balancing report. Failure to comply will result in holding retainage of the final payment until all items have been corrected to the satisfaction of the Engineer.
- F. The report shall be signed by the supervising registered professional engineer and affixed with their registration stamp, signed and dated in accordance with state law.

3.7 GUARANTEE OF WORK:

A. The Testing & Balancing Contractor shall guarantee the accuracy of the tests and balance for a period of 90 days from date of final acceptance of the test and balance report. During this period, the Testing & Balancing Contractor shall make personnel available at no cost to the Owner to correct deficiencies that may become apparent in the system balance.

END OF SECTION 230593

SECTION 230700 – INSULATION FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

- 1.1 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of mechanical insulation products and systems, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 3 years.
 - B. Installer's Qualifications: Firm with at least 5 years successful installation experience on projects with mechanical insulations similar to that required for this project.
 - C. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method. In addition, the products, when tested, shall not drip flame particles, and flame shall not be progressive. Provide Underwriters Laboratories Inc. label or listing, or satisfactory certified test report from an approved testing laboratory to prove that fire hazard ratings for materials proposed for use do not exceed those specified.
 - D. Definitions
 - 1. ASJ: All Surface Jacket.
 - 2. FSK: Foil Scrim Kraft.
 - 3. MRT: Mean Temperature Rating.
 - 4. NRTL: Nationally Recognized Testing Laboratory
 - 5. PCF: Pounds per Cubic Foot.
 - 6. PSF: Pounds per Square Foot.
 - 7. SSL: Self Sealing Lap
 - E. Codes and Standards:
 - 1. International Energy Conservation Code, currently adopted version.
 - 2. ASHRAE 90.1, latest edition.

1.2 SUBMITTALS:

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, k-value, thickness, density, and furnished accessories for each mechanical system requiring insulation. Submit detail product information and installation information for all jacketing systems specified in this section.

1.3 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.
- B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide product by one of the following:
 - 1. Mechanical Insulation:
 - a. Johns Manville Corp.
 - b. Owens-Corning Fiberglas Corp.
 - c. Knauf Fiber Glass
 - d. Manson
 - e. CertainTeed
 - f. Einsulation
 - g. Armacell
 - h. Pittsburgh Corning Corp.
 - i. Aeroflex.
 - j. PABCO, Inc.
 - k. Rubatex Corp.
 - I. Thermal Structures
 - 2. Jacketing & Covering Products:
 - a. Childers
 - b. Ceel-Co
 - c. Zeston
 - d. Alpha Associates, Inc.
 - e. Venture Tape
 - f. Polyguard

2.2 PIPING INSULATION MATERIALS:

- Fiberglass Piping Insulation: ASTM C 547, Class I unless otherwise indicated. ASJ-SSL Jacket with tensile strength of 35 lbs/in, mullen burst 70 psi, Beach Units puncture 50 oz. in/in, permeability 0.02 perm factory applied vapor barrier jacket and adhesive self-sealing lap joint.
 "K" factor shall be maximum 0.23 at 75°F MRT, 0.24 at 100°F MRT, 0.29 at 200°F MRT and 0.36 at 300°F MRT.
- B. Cellular Glass Piping Insulation: ASTM C 552, Type II, Class 2. Permeability of 0.00 perm. Preformed pipe insulation with factory-applied all-service jacket with self-sealing lap. "K" factor shall be maximum 0.28 at 50°F MRT, 0.29 at 75°F MRT, 0.31 at 100°F MRT, 0.38 at 200°F MRT and 0.45 at 300°F MRT.
- C. Calcium Silicate Piping Insulation: ASTM C533, Type I. "K" factor shall be maximum 0.538 at 500°F mean temperature, ASTM C165 compression strength >100 psi for 5 percent compression, transverse strength 200 psi for 5 percent compression, flexural strength 60 psi.
- D. Flexible Elastomeric, Closed Cell Piping Insulation: ASTM C 534, Type I. Water vapor permeability of 0.10 perm inches or less. Insulation shall be pre-installed on piping, or un-slit to be slipped over piping as a single piece. "K" factor shall be maximum 0.245 at 50°F MRT, 0.25 at 75°F MRT and 0.26 at 90°F MRT.
- E. Jackets for Piping Insulation:

- 1. ASTM C 921, Type I for piping with temperatures below ambient, Type II for piping with temperatures above ambient. Type I may be used for all piping at Installers option.
- 2. Fitting Covers: UV resistant PVC, pre-molded fitting covers, flame spread 25, smoke developed 50. PVC tape for cold systems, serrated tacks or PVC tape for hot systems.
- 3. Self-Adhesive Laminate Jacketing: Heavy duty multilayered laminate coated with an acrylic pressure sensitive adhesive. Embossed aluminum surface. Zero permeability vapor barrier for insulation cladding and jacketing applications. Superior resistance to weathering, mold, UV, and extreme environmental conditions.
 - a. Product thickness (flat): 17.5 mils
 - b. Product Thickness (embossed): 24.0 mils
 - c. Peel Adhesion: 100 oz/in
 - d. Tensile Strength: 187 lb/in
 - e. Puncture: 68 lbs
 - f. Water Vapor Transmission Rate (ASTM E96): 0.0
 - g. Service Temperature: -94 to 248 °F
 - h. VentureTape 1579GCW-E (VentureClad Plus) or equivalent.
- 4. Aluminum Jacketing: Manufactured from T3003 (or T/5005) H14 to H19 aluminum alloy with 3/16" corrugations and shall have a factory attached 1 mil thick polyethylene moisture barrier continuously laminated across the full width of the jacketing. Jacketing shall be 0.016" thick minimum. Provide matching factory fabricated covers for 90-degree and 45-degree elbows, tee fittings, flange fittings valve bodies, blind ends, reducers, and other fittings necessary to make the covering system complete, waterproof and weatherproof. All jacketing shall be color coated baked on polyester finish; color selected by Architect.
- PVC Jacketing: UV resistant PVC, 30 mil thick, flame spread 25, smoke developed 50, factory cut and curled to fit outside diameter of insulated pipe. Solvent weld adhesive for sealing joints and seams.
- 6. Rubber/Tedlar Jacketing: ASTM-D-1424-63, ASTM-D-774, and ASTM-E-84, manufactured from a combination of heavy fiberglass fabric coated with Hypalon Rubber, fully cured and laminated to a Tedlar facing. Jacketing will also be required to be vapor barrier and shall be laminated to a corrosion resistant aluminized Mylar. Jacketing shall be .010" thick minimum, UL Class I rated, acid and alkali resistant, and be both washable and paintable. Provide factory fabricated aluminum fitting covers with mil-polyethylene vapor barrier for all elbows, tees, flanges, valves, and other fittings. Alpha Associates Style TGH-1000 or equal.
- 7. Cloth Jacketing Material: Not less than 8 oz. per square yard with adhesives, cement and sealer as recommended by insulation manufacturer for the intended application. PVC premolded fitting covers shall not be provided.
- F. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.
- G. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated and additional finishes as specified.
- 2.3 DUCTWORK INSULATION MATERIALS:
 - A. Rigid Fiberglass Ductwork Insulation: ASTM C 612, Class I, 450°F temperature limit, density of 3 PCF. "K" value shall be maximum 0.23 at 75°F mean temperature, vapor transmission rating shall not exceed 0.02 perms, FSK facing.

- B. Round Surface Semi-Rigid Fiberglass Blanket Insulation: ATSM C 612, Class I, 450°F temperature limit, 2.5 PCF density "K" value of 0.25 max at 75°F mean temp, FSK facing. Orientation of fibers shall be perpendicular to facing to facilitate application on round surfaces.
- C. Flexible Fiberglass Ductwork Insulation: ASTM C 553, Type I, 3/4 lbs per cu. ft. density. "K" value shall be maximum 0.30 at 75°F mean temperature, 250°F temperature limit, vapor transmission rating shall not exceed 0.02 perms, FSK facing.
- D. Flexible Elastomeric Closed Cell Insulation: ASTM C534, Type II, "K" value shall be a maximum 0.28 at 75°F mean temp, 220°F Temperature limit, water vapor permeability rating of 0.10 perm inches or less.
- E. Jackets for Ductwork Insulation: ASTM C 921, Type I for ductwork with temperatures below ambient; Type II for ductwork with temperatures above ambient. Type I maybe used for all at Contractors option.
 - 1. Aluminum Jacketing: The jacketing shall be manufactured from T3003 (or T/5005) H14 to H19 aluminum alloy with 3/16 inch corrugations and shall have a factory attached 1 mil thick polyethylene moisture barrier continuously laminated across the full width of the jacketing. Jacketing shall be 0.016 inches thick minimum. Where available, provide matching factory fabricated covers for 90-degree and 45-degree elbows, tee fittings, branch fittings, reducers and other fittings necessary to make the covering system complete, waterproof and weatherproof. All jacketing shall be color coated baked on polyester finish; color selected by Architect.
 - 2. Rubber/Tedlar Jacketing: ASTM-D-1424-63, ASTM-D-774, and ASTM-E-84, manufactured from a combination of heavy fiberglass fabric coated with Hypalon Rubber, fully cured and laminated to a Tedlar facing. Jacketing will also be required to be vapor barrier and shall be laminated to a corrosion resistant aluminized Mylar. Jacketing shall be .010" thick minimum, UL Class I rated, acid and alkali resistant, and be both washable and paintable. Provide factory fabricated aluminum fitting covers with mil-polyethylene vapor barrier for all elbows, tees, and other fittings. Alpha Associates Style TGH-1000 or equal.
 - 3. Flexible closed cell elastomeric insulation shall be coated with two coats Armaflex WB Finish or other UV and weather coating. Barrier product recommended by the insulation manufacturer.
- F. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- G. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by insulation manufacturer for applications indicated.

2.4 EQUIPMENT INSULATION MATERIALS:

- A. Rigid Fiberglass Equipment Insulation: ASTM C 612, Type II. "K" factor shall be maximum 0.28 at 200°F mean temperature, 3.0 PCF density, 850°F temperature limit.
- B. Flexible Fiberglass Equipment Insulation: ASTM C 553, Type IV, "K" factor shall be maximum 0.45 at 250°F mean temperature. 850°F temperature limit.
- C. Calcium Silicate Equipment Insulation: ASTM C 533, Type I, Block. "K" factor shall be maximum 0.87 at 1000°F mean temperature, compression strength 200 psi for 5 percent compression, transverse strength 60 psi.

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- D. Flexible Closed Cell Elastomeric Insulation: ASTM C534, Type I, "K" valve shall be a maximum of 0.27 at 75°F mean temp, 220°F temperature limit, water vapor permeability of 0.10 perm inches or less.
- E. Jacketing Material for Equipment Insulation: Provide pre- sized glass cloth jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.
- F. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.
- G. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape, corner angles, anchors and stud pins as recommended by insulation manufacturer for applications indicated.

PART 3 - EXECUTION

- 3.1 MINIMUM INSULATION REQUIREMENTS
 - A. All mechanical systems shall be insulated in accordance with the locally adopted energy codes or the requirements of this specification section, whichever is more stringent.
- 3.2 GENERAL:
 - A. Examine areas and conditions under which mechanical insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.
 - B. Insulation shall be installed to allow maintenance and replacement of system components without compromising the insulation integrity or vapor barrier on cold systems.
 - C. Workmanship shall be first class and of the highest quality, poor installation or bad appearance as determined by the engineer shall be due cause to reject the entire project in whole and retainage will be withheld until corrective action is completed to the engineer's satisfaction.
- 3.3 HVAC PIPING SYSTEM INSULATION:
 - A. Insulation Omitted: Omit insulation on steam condensate piping between steam trap and union; and on hot piping unions, flexible connections, and expansion joints. Insulation may be omitted inside of cabinet unit heaters, convectors and fan coils for hot piping. Cold piping insulation inside fan coil unit cabinet may be omitted provided piping is located over drain pan. Hot and cold piping routed inside air handler units shall be insulated. Omit insulation on strainers in heating water strainers operating below 200°F.
 - B. Heating System Piping (105 to 200°F):
 - 1. Application Requirements: Insulate the following piping systems:
 - a. Hot water supply and return piping.
 - 2. Insulate each piping system specified above with the following type and thicknesses of insulation:

- a. Above Ground, Inside Building, Fiberglass:
 - 1) 1.5 inch thick insulation on pipe sizes 1-1/4 inch and smaller.
 - 2) 2 inch thick insulation on pipe sizes 1-1/2 inch and larger.
- b. Above Ground, Exterior, Cellular Glass:
 - 1) 2 inch thick insulation on pipe sizes 1-1/4 inch and smaller.
 - 2) 2.5 inch thick insulation on pipe sizes 1-1/2 inch and larger.

3.4 DUCTWORK SYSTEM INSULATION:

- A. Insulation Omitted: Do not insulate lined ductwork unless additional wrap is required to meet Energy Code.
- B. Application Requirements: Insulate the following ductwork and equipment:
 - 1. Outdoor air intake ductwork and plenums between air entrance and HVAC unit inlet.
 - 2. Mixed air ductwork and plenums between air entrance and HVAC unit inlet.
 - 3. HVAC supply ductwork between HVAC unit discharge, and room terminal outlet unless ductwork is specified to be lined.
 - 4. HVAC return ductwork in unconditioned spaces or exterior; except omit insulation when ductwork is specified to be lined.
 - 5. HVAC plenums and unit housings not pre-insulated at factory or lined.
 - 6. Rigid oval or round supply air ductwork.
 - 7. Induced draft fan scrolls.
- C. Insulate each ductwork system specified above with the following types and thicknesses of insulation:

	TYPE, THICKNESS				
APPLICATION	RIGID FIBERGLASS	FLEXIBLE FIBERGLASS	FLEXIBLE ELASTOMERIC		
Interior; concealed; cold, hot or dual temperature duct	1-1/2" minimum up to 2" as required to cover joints & reinforcements	1-1/2"	Not Allowed		
Interior; exposed within conditioned finished spaces; cold, hot, or dual temperature duct	None	None	None		
Interior; exposed within mechanical, storage, or other service areas; cold, hot, or dual temperature duct	1-1/2" minimum up to 2" as required to cover joints and reinforcements	Not Allowed	2" . Provide white finish coat.		

3.5 INSTALLATION OF PIPING INSULATION:

- A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.
- B. Install insulation on pipe systems subsequent to installation of heat tracing, testing, and acceptance of tests.

- C. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with single cut piece to complete run. Do not use cut pieces or scraps abutting each other.
- D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- E. Maintain integrity of vapor-barrier jackets on cold pipe insulation and protect to prevent puncture or other damage.
 - 1. Do not use staples or tacks on vapor barrier jackets.
 - 2. Seal vapor barrier penetrations with vapor barrier finish recommended by the manufacturer.
 - 3. Seal fitting covers with PVC tape.
 - 4. Cover all unions, check valves, and other in-line devices. Mark outer covering with indelible marker to identify item covered.
- F. Neatly bevel and seal insulation at all exposed edges.
- G. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.
- H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.
- I. See equipment insulation for removable insulation on accessible piping components.
- J. See Section 23 05 29 for insulation inserts and shields. Butt pipe insulation against pipe hanger insulation inserts. For all piping apply wet coat of vapor barrier lap cement on butt joints and seal all joints and seams with 3 inch wide vapor barrier tape or band.
- K. Flexible Elastomeric Piping Insulation:
 - 1. Install unslit, by slipping over piping prior to joining, or install pre-insulated soft copper tubing.
 - 2. Seal butt ends with adhesive.
- L. Cellular Glass Insulation:
 - 1. Apply in a single layer. Secure to pipe with $\frac{1}{2}$ inch wide aluminum bands.
 - 2. For indoor applications, apply all-purpose Kraft paper/aluminum foil/vinyl coating jacket. Seal all lap and butt joints with self-seal vapor barrier tape.
 - 3. For outdoor applications, apply aluminum rubber/Tedlar jacketing as described below.
- M. Calcium Silicate Insulation:
 - 1. Apply in a single layer. Secure to pipe with 1/2 inch wide aluminum bands.
 - 2. For indoor applications, provide canvas jacketing. Adhere joints of jacketing and provide a finish coat of sealant as recommended by the manufacturer.

3.6 INSTALLATION OF DUCTWORK INSULATION:

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

- B. Install insulation materials with smooth and even surfaces.
- C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- D. Maintain integrity of vapor-barrier on ductwork insulation and protect it to prevent puncture and other damage.
 - 1. Avoid the use of staples on vapor barrier jackets.
 - 2. Seal vapor barrier penetrations with vapor barrier tape recommended by the manufacturer.
- E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.
- F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation has been installed. Sound attenuators do not qualify for this omission.
- G. Flexible Fiberglass Insulation: Cut back insulation to provide a 2 inch facing overlap at all seams. Seams shall be stapled approximately 6 inches on center with outward clinching staples, then sealed with pressure-sensitive tape matching the facing and designed for use with duct insulation. The underside of ductwork 24 inches or greater shall be secured with mechanical fasteners and speed clips spaced approximately 18inches on center. The protruding ends of the fasteners should be cut off flush after the speed clips are installed, and then sealed with the same tape as specified above. Install with a maximum of 25% compression to maintain the manufacturer published installed R-value.
- H. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on all external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.
- I. Adhere flexible elastomeric sheets to clean oil-free metal surface by compression fit method and full coverage of adhesive. Seal butt joints with same adhesive. For exterior ductwork, notch insulation at reinforcements and joint flanges to provide a smooth surface, unless the reinforcements or joints would penetrate the insulation. Provide a minimum ½ inch cap over any penetrating item. Stagger all joints and seams on multi-layer insulation.
- 3.7 EXISTING INSULATION REPAIR:
 - A. Repair damaged sections of existing mechanical insulation, both previously damaged or damaged during this construction period. Use insulation, install new jacket lapping, and sealed over existing.

3.8 PROTECTION AND REPLACEMENT:

- A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 230700

SECTION 233113 - METAL DUCTS

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. Extent of metal ductwork is indicated on drawings and in schedules, and by requirements of this section.

DUCT SERVICE	TYPE/CONSTRUCTION
Supply air between fan and terminal boxes (medium and high).	Galvanized steel, spiral, round or oval or rectangular.
Supply air from discharge of terminal box/fan to air devices (low pressure).	Galvanized sheet metal /spiral round and oval or rectangular (lined as noted on drawings.)
Return air ductwork.	Galvanized steel (lined where noted on drawings); factory or shop fabricated.
General building exhaust.	Galvanized sheet metal (lined as noted on drawings); factory or shop fabricated.).
Transfer ducts.	Internally lined galvanized sheet metal as described above for low pressure supply; factory or shop fabricated.
Sound elbows for R.A. grilles	Galvanized sheet metal (internally lined).
	OR Fibrous glass ductboard.

- B. Exterior insulation of metal ductwork is specified in other Division-23 sections and is included as work of this section.
- C. Refer to other Division-23 sections for ductwork accessories.
- D. Refer to other Division-23 sections for fans and air handling units.
- E. Refer to other Division-23 sections for testing, adjusting, and balancing of metal ductwork systems.
- 1.2 DEFINITIONS:
 - A. Low Pressure Duct: Duct required by the drawings, specifications, or referenced standards to be constructed to 2" or less, positive, or negative pressure class.
 - B. Medium or High Pressure Duct: Duct required by the drawings, specifications, or referenced standards to be constructed to greater than 2" positive or negative pressure class.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of metal ductwork products of types, materials, and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.
- C. References to SMACNA, ASHRAE and NFPA are minimum requirements, the Contractor shall fabricate, construct, install, seal and leak test all ductwork as described in this specification and as shown on the drawings, in addition to these minimum standard references.
- D. Codes and Standards:
 - 1. SMACNA Standards: Comply with the current SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork. Comply with SMACNA "HVAC Air Duct Leakage Test Manual" for testing of duct systems.
 - 2. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".
 - 3. Air Diffusion Council (ADC) "Flexible Duct Performance and Installation Standards"
- E. SMACNA Industrial Construction Standards.
- F. Field Reference Manual: Have available for reference at project field office, copy of the current SMACNA "HVAC Duct Construction Standards, Metal and Flexible", and the current SMACNA "HVAC Air Duct Leakage Test Manual".
- 1.4 SUBMITTALS:
 - A. Product Data: Submit manufacturer's technical product data and installation instructions for ductwork materials and products. Provide product data for manufactured joining systems. Include sound attenuation by octave band for sound rated flexible duct.
 - B. Shop Drawings: Submit ¼" scaled fabrication and layout drawings of metal ductwork and fittings including, but not limited to, duct sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Show interface and spatial relationship between ductwork and proximate equipment. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that free area, materials, and rigidity are not reduced.
 - C. Clean Duct Protocol Procedures: Submit written procedures confirming compliance with the clean duct protocol.
 - D. Record Drawings: At project closeout, submit record drawings of installed systems, in accordance with requirements of Divisions 1 and 23.
 - E. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Divisions 1 and 23.

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- 1.5 DELIVERY, STORAGE, AND HANDLING:
 - A. Protection: Protect ductwork, accessories and purchased products from damage during shipping, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.
 - B. Storage: Store ductwork inside elevated from floor on pallets and protected from weather, dirt, dust and debris.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Acoustical Duct Liner:
 - a. CertainTeed Corp.
 - b. Johns Manville
 - c. Owens-Corning Fiberglas Corp.
 - d. Knauf Insulation
 - 2. Flexible Ducts:
 - a. Flexmaster
 - b. Thermaflex
 - 3. Duct Take Off Fittings
 - a. Hercules Industries
 - b. Flexmaster
 - c. Thermaflex
 - d. Ominair

2.2 DUCTWORK MATERIALS:

- A. Exposed Ductwork Materials: Where ductwork is exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains, dents, discolorations, labels, and other imperfections, including those which would impair painting.
- B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A 653, lockforming quality; with G 90 zinc coating in accordance with ASTM A 525; and mill phosphatized for exposed locations. Provide flat seam construction where standing seams are a hazard to the Owner's operation personnel.
- C. Stainless Steel Sheet: Where indicated, provide stainless steel complying with ASTM A 167; Type 304 or 316; with No. 4 finish where exposed to view in occupied spaces, No. 1 finish elsewhere. Protect finished surfaces with mill-applied adhesive protective paper, maintained through fabrication and installation.
- D. Aluminum Sheet: Where indicated, provide aluminum sheet complying with ASTM B 209, Alloy 3003, Temper H14.

- E. Uncoated carbon steel shall comply with ASTM A569, hot rolled steel sheet.
- 2.3 MISCELLANEOUS DUCTWORK MATERIALS:
 - A. General: Provide miscellaneous materials and products of types and sizes indicated and, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.
 - B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 15 deg. change of direction per section. Unless specifically detailed otherwise, use 45 deg. laterals and 45 deg. elbows for branch takeoff connections. Where 90 deg. branches are indicated, provide conical type tees.
 - C. Acoustical Duct Liner: Fibrous glass, complying with Thermal Insulation Manufacturers Association (TIMA) AHC-101; of thickness indicated.
 - Unless otherwise noted, provide 1" thick, 1-1/2 lb density, fiberglass duct liner meeting ASTM C1071 Type I, NFPA 90A and 90B and TIMA (AHC-101) with minimum NRC (noise reduction coefficient) of 0.70 as tested per STM C 423 using an "A" mounting with minimum "K" factor of 0.25. Lining shall be U.L. approved, made from flame attenuated glass fiber bonded with a thermosetting resin with acrylic smooth surface treatment and factory applied edge coating. Materials shall conform to revised NFPA No. 90A Standards, with a maximum flame spread of 25 and maximum smoke development of 50.
 - D. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation".
 - E. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.
 - F. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/ installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. All PVC coated exhaust ductwork shall be sealed with an approved chemical resistant sealant (P.V.S. #8-WB or approved equal). For outdoor ductwork, sealant shall also be U.V. resistant and weather resistant. Where ductwork is exposed to view in occupied spaces, utilize a clear, paintable duct sealant.
 - G. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.
 - 1. For exposed stainless steel ductwork, provide matching stainless steel support materials.
 - 2. For aluminum ductwork, provide aluminum support materials except where materials are electrolytically separated from ductwork.
 - H. Flexible Ducts: Flexible air ducts shall be listed under UL-181 standards as Class I Air Duct Material and shall comply with NFPA Standards 90A and 90B. Minimum operating pressure rating shall be 10" W.C. positive, 1" negative for sizes up to 12" through a temperature range of -20°F to 150°F; minimum working velocity rating shall be 4000 fpm. Contractor shall assume responsibility for supplying material approved by the authority having jurisdiction.
 - 1. All flexible duct shall be rated for sound attenuation. Inner core shall be black CPE supported by a galvanized steel helix, with minimum R-5 insulation and metalized reinforced outer jacket.
 - a. Flexmaster Type 1M
2. Sound attenuation shall be as scheduled below:

INSERTION LOSS dB (6-foot Section, Flexmaster 1M-R6, 500 FPM Air Velocity)							
Octave Band	125	250	500	1000	2000	4000	8000
8" Diameter	5.6	10.6	23.9	34.0	22.5	17.0	11.9
12" Diameter	6.6	27.8	22.8	29.0	18.7	10.9	8.2

- 3. Non-insulated flexible ducts shall be the same as insulated less the insulation and other jacket.
- I. Duct Take Off Fittings to Individual Air Inlets & Outlets: Provide conical spin-in fittings at flexible or round sheet metal duct takeoffs. Where specifically shown on drawings, where the duct dimension does not allow for a conical spin-in, or at Contractor's option, provide 45° inlet rectangular to round duct take off fittings, with factory applied gasket. Fittings shall include butterfly type manual volume damper with locking quadrant handle and 2" insulation stand-off. Shafts shall be solid metal, rolled metal shafts are not acceptable.
- J. Duct take off fittings to air terminals: same as for individual air inlets and outlets, less the damper.
- K. Underslab Ducts: For ductwork placed in concrete slabs, or under slabs on grade, fabricate PVC coated ductwork.
- L. All fasteners and hardware for stainless steel ductwork and PVC coated ductwork shall be made of stainless steel.
- 2.4 FABRICATION:
 - A. Fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible, so as to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match (-) mark sections for reassembly and coordinated installation.
 - B. Fabricate ductwork of gauges and reinforcement complying with the latest SMACNA "HVAC Duct Construction Standards". Minimum 26 GA where ducts are within corridors.
 - C. Where the standard allows the choice of external reinforcing or internal tie rods, only the external reinforcing options shall be used.
 - D. If manufacturer flange joining systems are used as part of the reinforcing, the EI rating and rigidity class shall be equivalent to the reinforcing requirements of the standard. Submit manufacturer's product data.
 - E. Aluminum duct shall be fabricated using the aluminum thickness equivalence table in the standard. Simply increasing the thickness by two gauges is not acceptable.
 - F. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows and offsets with center-line radius equal to 1.5 times the associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. 90° mitered elbows with turning vanes may

be used where specifically shown on drawings. Mitered elbows or offsets of other than 90° shall not be used. Two 90° mitered elbows shall be separated by a minimum of 2 equivalent duct diameters. Use radiused "Ogee" for offsets less than 90°. Limit angular tapers to 30 deg. for contracting tapers and 20 deg. for expanding tapers. Divided flow fittings shall be 45° inlet branches, stationary splitters and elbows, or as shown on drawings.

- G. Elbows with sharp throat and radius heel are not allowed.
- H. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division-23 section "Ductwork Accessories" for accessory requirements.
- I. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive, and fasten with mechanical fasteners. Provide sheet metal nosing on all leading edges preceded by unlined duct, at duct openings, and at fan or terminal unit connections.

2.5 ROUND AND FLAT OVAL DUCTWORK:

- A. Material: Galvanized sheet steel complying with ASTM A 527, lockforming quality, with ASTM A 525, G90 zinc coating, mill phosphatized. Spiral lockseam construction. Individual runouts to air devices may be longitudinal seam.
- B. Gauge: In accordance with the SMACNA "HVAC Duct Construction Standards", minimum 26 gauge.
- C. Elbows: One piece construction for 90 deg. and 45 deg. elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint. Radius to centerline shall be 1.5 times duct diameter. Spot welded and bonded construction. Elbows on runouts to individual air devices may be pleated or adjustable.
- D. Divided Flow Fittings: 90 deg. tees, constructed with branch spot welded and bonded to duct fitting body, with minimum 2" flange shaped to fit main duct.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION OF METAL DUCTWORK:
 - A. Duct Sealing:
 - 1. Seal all low pressure ducts to SMACNA Seal Class "B".
 - 2. Seal all medium and high pressure ducts to SMACNA Seal Class "A".
 - B. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight and noiseless (no objectionable noise) systems, capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true-to-shape and to prevent buckling, popping or compressing. Support vertical ducts at every floor.

- C. Construct ductwork to schedule of operating pressures as shown on drawings.
- D. Inserts: Install concrete inserts for support of ductwork in coordination with formwork, as required to avoid delays in work.
- E. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.
- F. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any. Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.
- G. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.
- H. Slope shower, locker room, and high moisture ductwork down to air device.
- I. Penetrations: Where ducts pass through fire rated walls and do not contain fire or smoke dampers, protect with fire stop material installed in accordance with its listing. Where ducts pass through interior partitions or exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gauge as duct. Overlap opening on all four sides by at least 1-1/2". Fasten to duct only. Where ducts penetrate non-fire rated, mechanical, electrical or acoustically sensitive walls, provide ½" to ¾" annular space between duct and wall, pack annular space with mineral wood insulation, and caulk both sides with non-hardening acoustical sealant.
- J. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of ductwork system.
- K. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards and Industrial Construction Standards.
- L. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent entrance of dust and debris until time connections are to be completed.
- 3.3 INSTALLATION OF DUCT TAKE-OFF FITTINGS:
 - A. Fully seal all joints.
 - B. Sheet metal screw regulator arm to duct after balance is complete. Mark and date position of regulator arm.
 - C. Insulation over regulator arm is not required.

3.4 INSTALLATION OF DUCT LINER:

- A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.
- 3.5 INSTALLATION OF FLEXIBLE DUCTS:
 - A. Maximum Length: For any duct run using flexible ductwork, do not exceed 6' 0".
 - B. Installation: Install in accordance with SMACNA's, "HVAC Duct Construction Standards, Metal and Flexible" and ADC "Flexible Duct Performance and Installation Standards".
 - C. Full inside diameter of flexible duct shall be maintained. Support to prevent kinking. Do not bend ducts across sharp corners of building elements such as joists.
 - D. Flexible duct shall not be installed above an inaccessible ceiling unless the air device is set in a frame allowing access to both ends of the flexible duct.
 - E. Install ducts fully extended. Do not install in the compressed state.
- 3.6 FIELD QUALITY CONTROL:
 - A. Leakage Tests: Conduct duct leakage test in accordance with SMACNA HVAC Air Duct Leakage Test Manual. Repair leaks and repeat tests until total leakage is less than the maximum permissible leakage as specified below.
 - B. General:
 - 1. Ductwork pressure tests shall be observed by Architect/Engineer prior to installation of insulation.
 - Ductwork systems in ±3" W.G. pressure class and higher, regardless of system operating pressure, shall be tested in their entirety for leaks. Arbitrary sections of ductwork in ±2" W.G. and lower pressure class, regardless of system operating pressure, shall be tested as required by Architect/Engineer.
 - 3. Test Failures: Duct systems shall be repaired if test pressure and leakage requirements are not met or if air noise condition is encountered. Repairs and sealing shall be done with sheet metal, tape, sealant or a combination thereof.
 - C. Test Equipment:
 - 1. Portable rotary type blower or tank type vacuum cleaner with control damper. Equipment shall have sufficient capacity to properly test reasonably large duct system section. Equipment shall have been calibrated within 2 years of the testing.
 - 2. Orifice assembly consisting of straightening vanes and calibrated orifice plate mounted in a straight tube with properly located pressure taps.
 - 3. Two (2) U-tube manometers, one to measure drop across calibrated orifice and one to measure S.P. in duct being tested. Provide low differential pressure Dwyer magnehelic gauges for low leak testing in lieu of U-tube manometers.
 - 4. Provide Dwyer magnehelic gauge with 0-.25" W.C. range for testing 0% leakage ductwork.
 - D. Testing Pressures and Permissible Leakage:
 - 1. Test pressure shall be equal to the construction class. Negative pressure duct shall be tested at the equivalent positive pressure.

2. Allowable leakage shall be determined from the following equation (or figure 4-1 in the above referenced Standard):

 $F = C_L (P)^{.65}$

Where:

F = Allowable leakage factor CFM/100 Sq. Ft. C_L = Leakage Class P = Test pressure inches W.C.

- 3. Leakage class shall be as follows:
 - Seal class A, Round or oval duct, $C_{L} = 3$. a.
 - Seal class A, Rectangular duct, $C_1 = 6$. b.
 - Seal class B, Round or oval duct, $C_L = 6$. C.
 - Seal class B, Rectangular duct, $C_L = 12$. d.
 - Seal class C, Round or oval duct, $C_L = 12$. e.
 - f. Seal class C, Rectangular duct, $C_L = 24$.
- 4. Record all tests using the procedure and forms in the above referenced standard.
- 5. All plenums and casings shall be tested by pressuring to the pressure class indicated and visually observing leakage and panel deflection.
 - No noticeable leakage shall be allowed. a.
 - Deflection shall be less than 1/8" per foot. b.

3.7 EQUIPMENT CONNECTIONS:

General: Connect metal ductwork to equipment as indicated. Provide flexible connection for Α. each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors where required for service, maintenance and inspection of ductwork accessories. See section 23 33 00.

3.8 ADJUSTING AND CLEANING:

- Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external Α. surfaces of foreign substances. Where ductwork is to be painted clean and prepare surface for painting.
- Β. Protection:
 - 1. Store duct a minimum of 4" above ground or floor to avoid damage from weather or spills.
 - Cover all stored ducts to protect from moisture, dust, or debris. 2.
 - 3. Maintain a cover on all ends of installed ductwork at all times, except when actually connecting additional sections of duct.
- C. Ductwork contaminated or damaged above "shop" or "mill" conditions shall be cleaned, repaired or replaced to the Engineer's satisfaction.
 - 1. Ductliner pre-installed in stored duct which has become wet may be installed if first allowed to completely dry out.
 - Ductliner in installed ductwork which has become wet must be completely removed and 2. replaced.
 - 3. Torn ductliner may be repaired by coating with adhesive if damage is minor and isolated. Extensively damaged liner shall be replaced back to a straight cut joint.

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- D. Protect lined duct from becoming wet or torn.
- E. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.
- F. Balancing: Refer to Division-23 section "Testing, Adjusting, and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

- 1.1 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of ductwork accessories, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
 - C. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers" and U.L. Standard 555S "Motor-Driven Fire/Smoke Dampers."
 - D. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.
 - E. SMACNA Compliance: All exhaust ducts comply with "Fire Damper and Heat Stop Guide".
 - F. All fire dampers, smoke dampers, fire/smoke dampers and radiation dampers shall meet the latest local building code requirements.
 - G. Actuators shall be UL 2043 listed for low smoke generation if installed in an environmental air moving plenum as required by NFPA 70 and the International Mechanical Code.

1.2 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory, including dimensions, capacities, and materials of construction; and installation instructions.
- B. Shop Drawings: Submit manufacturer's assembly-type shop drawings for each type of ductwork accessory showing interfacing requirements with ductwork, method of fastening or support, and methods of assembly of components. Include details of construction equipment and accessories being provided.
- C. Submittals for all damper types specified in this section shall include a schedule for each damper indicating net free area, actual face velocity and pressure drop (at sea level) based on net free area & the maximum air quantity which will be passing through the damper. Submittals without this information will be rejected.
- D. Submit Heresite duct/equipment protective coating product data sheets and application instruction.
- E. Record Drawings: At project closeout, submit record drawings of installed systems products, in accordance with requirements of Division 23.
- F. Maintenance Data: Submit manufacturer's maintenance data including parts lists for each type of duct accessory. Include this data, product data, and shop drawings in maintenance manual; in accordance with requirements of Division 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Dampers:
 - a. Greenheck
 - b. AWV
 - c. Air Balance, Inc.
 - d. Anemostat
 - e. Arrow Louver and Damper; Div. of Arrow United Industries, Inc.
 - f. Louvers & Dampers, Inc.
 - g. Penn Ventilator Co.
 - h. Pottorff
 - i. Ruskin
 - j. Nailor
 - 2. Turning Vanes:
 - a. Aero Dyne Co.
 - b. Airsan Corp.
 - c. Barb-Aire
 - d. Duro Dyne Corp.
 - e. Environmental Elements Corp.; Subs. Koppers Co., Inc.
 - f. Hart & Cooley Mfg. Co.
 - 3. Duct Hardware:
 - a. Ventfabrics, Inc.
 - b. Young Regulator Co.
 - c. Duro-Dyne Corp.
 - 4. Duct Access Doors:
 - a. Kees
 - b. Ductmate
 - c. Greenheck
 - d. Flexmaster
 - e. Cesco-Advanced Air
 - f. Duro Dyne Corp.
 - g. Flame Gard
 - 5. Flexible Connections:
 - a. Duro Dyne Corp.
 - b. Ventfabrics, Inc.
 - c. General Rubber Corp. (Process & Exhaust Only)

2.2 MANUAL VOLUME DAMPERS:

A. Low Pressure Rectangular Dampers (less than 2000 FPM and under 2" W.C. S.P. Differential):

- 1. For 12" in height or larger, use multiple opposed blade type and close fitted to ducts. The frame and blades shall be constructed of 16 ga. galvanized steel with plated steel shaft mounted with synthetic bearings. Linkage shall be in-jamb fixed type located outside the airstream made of plated steel tie bar and crank plates, with stainless steel pivots. Damper panels shall not exceed 48" wide. Provide jack shafting when duct size required is greater than 48" wide. Provide notched shaft end indicating damper position, locking quadrant to fix damper position and handle. Provide standoff bracket for insulated ducts. For flat oval and round ductwork, provide type C housing.
- 2. For ducts less than 12" in height, frame shall be 18 ga. blade galvanized steel, steel axle with synthetic bearings locking quadrant handle and notched shaft end indicating damper position. Provide standoff bracket for insulated ducts.
- B. Low Pressure Round Dampers (less than 1800 FPM and under 1" W.C. S.P. differential):
 - 1. For low pressure spin-in fitting dampers serving individual returns/diffusers, see 23 31 13.
 - 2. Dampers 4" diameter through 18" diameter shall be 20 ga. galvanized steel frame and blade, utilize multi-blade square dampers with transitions for ducts over 18" diameter.
 - 3. Axle shaft shall be plated steel with retainers mounted on synthetic bearings with notched end shaft indicating damper position, locking quadrant and handle. Provide standoff brackets for insulated ducts.
 - a. Greenheck MBDR-50 or approved equivalent.
- C. Medium/High Pressure Rectangular Dampers (less than 4000 FPM and under 6" W.C. (48" wide or less) S.P. or 8" W.C. S.P. (36" wide or less)):
 - 1. Dampers shall be opposed blade for volume control and parallel blade for isolation/shut-off service.
 - 2. Frame shall be 16 ga. galvanized steel with welded corners or 1/8" thick 6063-T5 alloy aluminum frame. Blades shall be double skin galvanized steel with single-lock seam, or .081" thick 6060-T5 extruded aluminum, airfoil shape. Blade edge seals shall be vinyl, silicone, or other approved synthetic and metallic compression seals at the jambs. Axles shall be hexagonal or square plated steel mounted on bronze oilite or synthetic (ACETAL) bearings. Linkage shall be in-jamb type located outside the airstream. Maximum damper size shall be 48" wide and 60" high. For isolation or shut-off duty, damper leakage shall not exceed 9.5 CFM/Ft² at 4" W.C. S.P. differential. Provide extended shaft with notched end indicating damper position, locking quadrant and handle. Provide standoff brackets for insulated ducts.
- D. Medium/High Pressure Round and Flat Oval Dampers (less than 3000 FPM and under 4" W.C. S.P. differential):

1. Damper frame construction shall be galvanized steel as follows:

14 Gauge
Ũ
2 x 1/2 x 14 gauge channel
2 x 1/2 x 1/8 channel

2. Damper blades shall be galvanized steel as follows:

ROUND

4" to 18" diameter	
FLAT OVAL	5
4" to 18" Wide	12 Gauge

- 3. Axles shall be 1/2" diameter plated steel up to 18" diameter and 18" wide flat oval, and 3/4" diameter plated steel over 18". Stainless sleeve bearings pressed in to the frame.
- 4. Provide notched end shaft to indicate damper position, locking quadrant and lever handle. Provide standoff bracket for insulated duct.
- For isolation or shut-off service dampers shall be provided with edge seals with a leakage rate not to exceed 7 CFM/ft² at 1" W.C. S.P. differential (based on 18" diameter).
- E. Dampers in stainless steel duct shall be of equivalent construction to the above dampers, with all components made of stainless steel. Type 304 or 316, as specified for the ductwork.
- F. Dampers in aluminum duct shall be of equivalent construction to the above dampers, with all components made of either aluminum or stainless steel.

2.3 TURNING VANES:

- A. Fabricated Turning Vanes: Provide fabricated 22 gauge, single blade or 24 gauge double bladed 4-1/2" radius, 3-1/4" spacing turning vanes and type 2, 4-1/2" wide runners, constructed in accordance with SMACNA "HVAC Duct Construction Standards" Fig 2.3.
- B. Turning vanes as a part of PVC coated air systems shall be PVC coated.
- C. Do not use trailing edge turning vanes.
- 2.4 DUCT HARDWARE:
 - A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
 - B. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
 - C. Quadrant Locks: Provide for each manual volume damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

2.5 DUCT ACCESS DOORS:

- A. Access Doors for Low Pressure Rectangular Duct: Construct of same or greater gauge as ductwork served, provide double wall insulated doors for insulated ductwork. Exposed insulation adhered to door is not acceptable. Provide flush frames for uninsulated ductwork, extended frames for externally insulated duct. All access doors shall have gasket and will be air tight. Provide one side hinged, other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors. Where a hinged door cannot be fully opened a removable door may be used.
- B. Access Doors for Medium and High Pressure Rectangular Duct: Insulated double wall round door and frame arranged for "Spin-In" installation, with continuous gasket in frame for door. Leakage of less than 0.5 cfm at 6" W.G.

- C. Flexmaster "Inspector Series Spin Door" or equivalent.
- D. Access Doors for Round Duct 20" and Less: Sandwich type door, constructed of an insulated double wall outer door connected to gasketed inner plate carriage bolts with hand knobs, and formed to fit the radius of the duct.
 - 1. Ductmate "Sandwich" or equivalent.
- E. Access Door for Round Duct Greater Than 20": 18" round insulated double wall access door in gasketed frame, attached to duct section similar to tee fitting.
- F. Access Doors for Flat Oval Duct: Use door specified for medium and high pressure rectangular duct in flat portion, use door specified for round duct in curved portion.
- G. Access Doors for use in Type I commercial cooking hood ductwork (grease exhaust): 16 ga Black Steel, or Stainless steel where used on stainless steel ducts. High temp ceramic fiber gasket rated to 2300 °F. Inner frame to support duct cutout and accept studs and bolts. Multiple studs with wing nut or wing bolts on door. Provide studs as required to accept exterior rated duct wrap to meet wrap assembly requirements. Provide handles. Door assembly shall be rated for temperatures up to 2300°F as required by NFPA 96 and shall be UL listed as a Hood and Duct Accessory. Flame Gard Grease Duct Access Door or equivalent.
- H. All access doors in other than standard galvanized steel duct systems shall be of the same material or with the same coating as the duct system.

2.6 FLEXIBLE CONNECTIONS:

- A. General: Provide flexible duct connections wherever ductwork connects to vibration isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibrations of connected equipment. Shelf life shall be verified to not exceed six (6) months. Any sign of cracking on interior or exterior shall be cause for replacement immediately.
- B. Use the following product types for each application accordingly:
 - Indoor Equipment Non-Corrosive Air Systems: Heavy glass fabric, double-coated with DuPont's NEOPRENE, non-combustible fabric, fire retardant coating with good resistance to abrasion and flexing. Fabric shall be 30 oz per square yard, capable of operating at -10°F to 200°F, waterproof, air tight, 6 inches wide, complies with NFPA 90 and UL Standard #214. "Ventglas" Model as manufactured by VentFabric, Inc.
 - 2. Outdoor Equipment Non-Corrosive Air Systems (exposed to weather and sun): Heavy glass fabric, double-coated with DuPont's HYPALON, non-combustible fabric, fire retardant coating with superb resistance to sunlight, ozone and weather which has documented 20-year-old exposure tests. Fabric shall be 26 oz per square yard, capable of operating at -10°F to 250°F, waterproof, air tight, 6 inches wide, complies with NFPA 90 and UL Standard #214. "Ventlon" Model as manufactured by VentFabrics, Inc.
 - 3. High Temperature Non-Corrosive Air Systems: Heavy glass fabric coated with silicone rubber, non-combustible fabric, fire retardant coating, capable of operating and maintaining flexibility between temperatures of -25°F to 500°F. Fabric shall be 16 oz. per square yard, waterproof, air tight, 6 inches wide, complies with NFPA 90, UL Standard #214. "Ventsil" Model as manufactured by VentFabrics, Inc.
 - 4. Indoor Corrosive Air System: Heavy glass fabric coated with DuPont's Teflon fluorocarbon resins, capable of operating between temperatures of 20°F and 500°F.

Fabric shall be 14 oz per square yard, watertight, air tight, chemically resistant to most chemicals including but not limited to sulfuric acid, acetic acid, chlorine, dimethyl ether, xylene, hexane, ozone, nitric acid, butyl acetate, ammonia gas and liquid, acetone, mercury, cyclohexane, methanol, 6 inches wide "Ventel" model as manufactured by VentFabrics, Inc.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to the Engineer.

3.2 INSTALLATION OF DUCTWORK ACCESSORIES:

- A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.
- B. Install turning vanes in square or rectangular 90 deg. elbows in supply, return and exhaust air systems, and elsewhere as indicated.
- C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.
- D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.
- E. Provide duct access doors whether shown or not for inspection and cleaning upstream of all coils, fans, automatic dampers, fire dampers (minimum 16" x 24" in ducts larger than 18"), fire/smoke dampers, duct smoke detectors and elsewhere as indicated. Review locations prior to fabrication. Provide multiple access doors for large ductwork to provide adequate reach to equipment.
- F. Install fire dampers and smoke dampers in accordance with manufacturer's instructions.
- G. Provide fire dampers and smoke dampers at locations shown, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction.
- H. Provide balancing dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts and as required for air balancing.
- I. Provide balancing dampers on high pressure systems where indicated. Use splitter dampers only where indicated on Drawings.
- J. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and equipment subject to forced vibration. Provide matching flanged backing frame with flexible connector where flanged fan connections are provided.

3.3 COORDINATION:

A. Coordinate with installers of other work to ensure that operators, reset devices, and fusible links are accessible at all fire, smoke, and fire/smoke dampers.

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- B. Show access space on coordination drawings. Locate over lay-in ceilings and above corridors wherever practical.
- C. Order right/left/top/bottom arrangement as required to minimize field modifications.
- 3.4 FIELD QUALITY CONTROL:
 - A. Operate installed ductwork accessories after installation to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leakproof performance.
 - B. After installation, test every fire, smoke, and fire/smoke damper for proper operation, provide letter to the Architect/Engineer certifying this work is complete and all dampers are functioning properly.
 - 1. Verify that each fire/smoke damper closes when the associated duct or space detector is tripped. Verify that air handlers shut down and outside air dampers close as dictated by the control sequence.
 - 2. Verify that air supply units shut down when smoke is detected by the associated duct detector. Verify that outside air dampers and system fire/smoke dampers close as dictated by the control sequence.
 - 3. Report any detectors or dampers that are malfunctioning. Report any discrepancies from the control sequence.
- 3.5 ADJUSTING AND CLEANING:
 - A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
 - B. Label access doors in accordance with Division-23 section "Mechanical Identification".
 - C. Final positioning of manual dampers is specified in Division-23 section "Testing, Adjusting, and Balancing".
 - D. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.
 - E. Touch up all scratches in PVC or Heresite coated surfaces with respective coating finish.
- 3.6 EXTRA STOCK:
 - A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION 233300

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SECTION 233713 – DIFFUSERS, REGISTERS & GRILLES

PART 1 - GENERAL

- 1.1 DESCRIPTION OF WORK:
 - A. Extent of air outlets and inlets work is indicated by drawings and schedules, and by requirements of this section.
 - B. Types of air outlets and inlets required for project include the following:
 - 1. Ceiling air diffusers.
 - C. Refer to other Division 23 sections for ductwork, duct accessories; testing and balancing; not work of this section.
- 1.2 QUALITY ASSURANCE:
 - A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of air outlets and inlets of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
 - B. Codes and Standards:
 - 1. AHRI Compliance: Test and rate air outlets and inlets in accordance with AHRI 650 "Standard for Air Outlets and Inlets".
 - 2. ASHRAE Compliance: Test and rate air outlets and inlets in accordance with ASHRAE 70 "Method of Testing for Rating the Air Flow Performance of Outlets and Inlets".
 - 3. ADC Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ADC 1062 "Certification, Rating and Test Manual".
 - 4. ADC Seal: Provide air outlets and inlets bearing ADC Certified Rating Seal.
 - 5. AMCA Compliance: Test and rate louvers in accordance with AMCA 500 "Test Method for Louvers, Dampers and Shutters".
 - 6. AMCA Seal: Provide louvers bearing AMCA Certified Rating Seal.
 - 7. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

1.3 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
 - 1. Schedule of air outlets and inlets indicating drawing designation, room location, number, furnished, model number, size, and accessories furnished.
 - 2. Data sheet for each type of air outlet and inlet, and accessory furnished; indicating construction, finish, and mounting details.
 - 3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature and velocity traverses, throw and drop, and noise criteria ratings. Indicate selections on data.
- B. Samples: Submit 3 samples of each type of finish furnished.
- C. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

- D. Record Drawings: At project closeout, submit record drawings of installed systems products, in accordance with requirements of Division 23.
- E. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 23.
- 1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:
 - A. Deliver air outlets and inlets wrapped in factory- fabricated fiber-board type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.
 - B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors; when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
 - 1. Diffusers, Registers and Grilles:
 - a. Anemostat
 - b. Price
 - c. Carnes
 - d. Krueger
 - e. Titus
 - f. Metal-Aire
 - g. Carnes
 - h. Nailor

2.2 CEILING AIR DIFFUSERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.
- D. Types: Provide ceiling diffusers of type, capacity, and with accessories and finishes as listed on air device schedule.

2.3 REGISTERS AND GRILLES:

- A. General: Except as otherwise indicated, provide manufacturer's standard registers and grilles where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.
- B. Performance: Provide registers and grilles that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.
- C. Wall Compatibility: Provide registers and grilles with border styles that are compatible with adjacent wall systems, and that are specifically manufactured to fit into wall construction with accurate fit and adequate support. Refer to general construction drawings and specifications for types of wall construction, which will contain each type of wall register and grille.
- D. Types: Provide registers and grilles of type, capacity, and with accessories and finishes as listed on air device schedule.

PART 3 - EXECUTION

3.1 INSPECTION:

- A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
- 3.2 INSTALLATION:
 - A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.
 - B. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.
 - C. Locate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling modules.

3.3 SPARE PARTS:

A. Furnish to Owner, with receipt, 3 operating keys for each type of air outlet and inlet that require them.

END OF SECTION 233713

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SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. All drawings associated with the entire project, including general provisions of the Contract, including The General Conditions of the Contract for Construction, General and Supplementary Conditions and Division-1 Conditions specification sections shall apply to the Division 26 specifications and drawings. The Contractor shall be responsible for reviewing and becoming familiar with the aforementioned and all other Contract Documents associated with the project.
- B. Related Sections: Refer to all sections in Division 23. Refer to Division 26 and 28 specification sections and Division 26 and 28 drawings.
- C. Where contradictions occur between this section and Division 1, the more stringent requirement shall apply.
- D. Contractor shall be defined as any and all entities involved with the construction of the project.

1.2 SUMMARY:

A. This Section specifies the basic requirements for electrical installations and includes requirements common to more than one section of Division 26 and Division 28. It expands and supplements the requirements specified in sections of Division 1 through 23.

1.3 ELECTRICAL INSTALLATIONS:

- A. Drawings are diagrammatic in character and do not necessarily indicate every required conduit, box, fitting, etc.
- B. Drawings and specifications are complementary. Whatever is called for in either is binding as though called for in both. Report any discrepancies to the Engineer and obtain written instructions before proceeding. Where any contradictions occur between the specifications and the drawings the more stringent requirement shall apply. The contractor shall include pricing for the more stringent and expensive requirements.
- C. Drawings shall not be scaled for rough-in measurements or used as shop drawings. Where drawings are required for these purposes or have to be made from field measurement, take the necessary measurements and prepare the drawings.
- D. The exact location for some items in this specification may not be shown on the drawings. The location of such items may be established by the Engineer during the progress of the work.
- E. The contractor shall make the installation in such a manner as to conform to the structure, avoid obstructions, preserve headroom and keep openings and passageways clear,

without further instructions or costs to the Owner. All equipment shall be installed so access is maintained for serviceability.

- F. Before any work is begun, determine that equipment will properly fit the space and that conduit can be run as contemplated without interferences between systems, with structural elements or with the work of other trades.
- G. Verify all dimensions by field measurements.
- H. Arrange for chases, slots, and openings in other building components to accommodate electrical installations.
- I. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring an access path for positioning prior to closing-in the building or space.
- J. Where mounting heights are not detailed or dimensioned, install electrical conduits, boxes, and overhead equipment to provide the maximum headroom possible. In general, keep installations tight to structure.
- K. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components as much as practical, and connect equipment for ease of disconnecting and removal with minimum of interference with other installations.
- L. Make allowance for expansion and contraction for all building electrical components and conduit systems that are subject to such.
- M. The ceiling space shall not be "layered". It is the contractor's responsibility to offset and coordinate any systems as required to allow installation within the identified ceiling cavity. The contractor shall include labor and material in the base bid to accommodate such offsets.
- N. In general, all conduit systems shall be routed as high as possible. Keep all equipment in accessible areas such as corridors and coordinate with systems and equipment from other sections.
- O. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
- P. Coordinate the installation of electrical materials and equipment above and below ceilings with suspension system, luminaires and other building components. Ductwork and piping shall not be installed above electrical panelboards, switchboards, motor control centers, and transformers.

1.4 COORDINATION:

A. Work out all installation conditions in advance of installation. The Contractor shall be responsible for preparing coordination drawings, showing all work, in all areas. The Contractor shall be responsible for providing all labor and material, including but not limited to all fittings, hangers, control devices, lighting, low voltage equipment, cable tray, conduit, transformers, disconnects, etc., necessary to overcome congested conditions at no increase in contact sum. The Contractors base bid shall include any and all time and manpower necessary to develop such coordination efforts and drawings. Increases to contract sum or schedule shall not be considered for such effort.

- B. Provide proper documentation of equipment, product data and shop drawings to all entities involved in the project. Coordination shall include, but not be limited to the following:
 - 1. Fire Alarm Contractor shall provide shop drawings to other Contractors as required.
 - 2. Automatic Temperature Controls, Building Management and Testing, Adjusting and Balancing Contractors shall be provided with equipment product data and shop drawings from other Division 23 and Division 26 Contractors and shall furnish the same information involving control devices to the appropriate Contractor.
- C. Existing Conditions:
 - 1. Contractor shall carefully survey existing conditions prior to bidding work. In addition, Contractor shall complete a thorough ceiling cavity survey.
 - 2. Provide proper coordination of electrical work with existing conditions.
 - 3. Contactor shall report any issues or conflicts immediately to Engineer before commencing with work and prior to purchasing equipment and materials.

1.5 COORDINATION WITH OTHER DIVISIONS:

- A. General:
 - 1. Coordinate all work to conform to the progress of the work of other trades.
 - 2. Complete the entire installation as soon as the condition of the building will permit. No extras will be allowed for corrections of ill-timed work, when such corrections are required for proper installation of other work.
 - B. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install mechanical and electrical systems within the cavity space allocation in the following order of priority:
 - 1. Equipment and required clearances
 - 2. Plumbing waste, cooling coil drain piping and roof drain mains and leaders.
 - 3. Ductwork mains.
 - 4. Plumbing vent piping.
 - 5. Low pressure ductwork and air devices.
 - 6. Electrical and communication conduits, raceways and cable tray.
 - 7. Domestic hot and cold water.
 - 8. Hydronic piping.
 - 9. Fire sprinkler mains, branch piping and drops (locate as tight to structure as possible).
 - 10. DDC control wiring and other low voltage systems.
 - 11. Fire alarm systems.
 - C. Chases, Inserts and Openings:
 - 1. Provide measurements, drawings and layouts so that openings, inserts and chases in new construction can be built in as construction progresses.
 - 2. Check sizes and locations of openings provided, including the access panels for equipment in hard lid ceilings and wall cavities.
 - 3. Any cutting and patching made necessary by failure to provide measurements, drawings and layouts at the proper time shall be done at no additional cost in contract sum.

- D. Support Dimensions: Provide dimensions and drawings so that concrete bases and other equipment supports to be provided under other sections of the specifications can be built at the proper time.
- E. Coordinate the installation of required supporting devices and sleeves to be set in poured in place concrete and other structural components, as they are constructed.
- F. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- G. Modifications required as result of failure to resolve interferences or call attentions to changes required in other work as result of modifications shall be paid for by responsible Contractor/Subcontractor.

1.6 DESIGN WORK REQUIRED BY CONTRACTOR:

- A. The construction of this project requires the Contractor to include the detailing and design of several systems and/or subsystems. All such design work shall be the complete responsibility of the Contractor.
- B. The Contractor shall take the full responsibility to develop and complete routing strategies which will allow fully coordinated system to be installed in a fully functional manner. The Engineers contract drawings shall be for system design intent and general configurations.
- C. Systems or subsystems which require design responsibility by the contractor include but are not limited to:
 - 1. Temporary Facilities.
 - 2. Final coordinated distribution systems within the ceiling cavity.
 - 3. Any system not fully detailed.
 - 4. Fire alarm shop drawings.
 - 5. Equipment supports, hangers, anchors and seismic systems not fully detailed nor specified in these documents, or catalogued by the manufacturer.
 - 6. Seismic restraint systems.

1.7 PROJECT CONDITIONS:

- A. The contractor shall be required to attend a pre-bid walk-thru if required and shall make themselves familiar with the existing conditions. No additional costs to the Owner shall be accepted for additional work for existing conditions.
- B. Field verify all conditions prior to submitting bids.
- C. Report any damaged equipment or systems to the Owner prior to any work.
- D. Protect all work against theft, injury or damage from all causes until it has been tested and accepted.
- E. Be responsible for all damage to the property of the Owner or to the work of other contractors during the construction and guarantee period. Repair or replace any part of the work which may show defect during one year from the final acceptance of all work, provided such defect is, in the opinion of the Architect, due to imperfect material or workmanship and not due to the Owner's carelessness or improper use.

- F. The Contractor shall coordinate and co-operate with Owner at all times for all new to existing connections.
- G. Coordinate all services shut-down with the Owner; provide temporary services. Coordinate any required disruptions with Owner, at a minimum one week in advance.
- H. Minimize disruptions to operation of electrical systems in occupied areas.
- 1.8 SAFETY:
- A. Refer to Division 1.

1.9 EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENTS:

- A. Refer to Division 1 and conform with the Owners requirements.
- 1.10 REQUIREMENTS OF REGULATORY AGENCIES:
 - A. Refer to Division 1.
 - B. Execute and inspect all work in accordance with Underwriters Laboratories (UL), and all local and state codes, rules and regulations applicable to the trade affected as a minimum, but if the plans and/or specifications call for requirements that exceed these rules and regulations, the more stringent requirement shall be followed. Follow application sections and requirements and testing procedures of NFPA, IEEE, NEMA, CBM, ANSI, NECA, ICEA, NETA, and IETA.
 - C. Comply with standards in effect at the date of these Contract Documents, except where a standard or specific date or edition is indicated.
 - D. Energy Codes: All equipment and installations shall conform to Federal, State, and local Energy Conservation Standards.
 - E. The handling, removal and disposal of regulated liquids or other materials shall be in accordance with U.S. EPA, state and local regulations.
 - F. The handling, removal and disposal of lead based paint and other lead containing materials shall comply with EPA, OSHA, and any other Federal, State, or local regulations.
 - G. After entering into contract, Contractor will be held to complete all work necessary to meet these requirements without additional expense to the Owner.
 - H. All material used on this project shall be UL listed and labeled and be acceptable to the authority having jurisdiction as suitable for the use intended.
- 1.11 PERMITS AND FEES:
 - A. Refer to Division 1.

- B. Contractor shall pay all fees required for connection to municipal and public utility facilities.
- C. Contractor shall arrange for and pay for all inspections, licenses and certificates required in connection with the work.

1.12 PROJECT SEISMIC REQUIREMENTS:

- A. Installation shall comply with the local seismic requirements for the area of installation. Provide restraints, bracing, anchors, vibration isolation, seismic snubbers, and all other components required for the installation.
- B. All electrical and fire alarm systems shall be installed to meet NFPA and IBC Seismic requirements.
 - 1. Where any conflicts arise the more stringent requirements shall be applicable.
 - 2. The design of the seismic requirements shall be the responsibility of the contractor.

1.13 TEMPORARY FACILITIES:

- A. Light, Heat, Power, Etc. Responsibility for providing temporary electricity, heat and other facilities shall be as identified in these specifications, as shown on the drawings and as specified in Division 1.
- B. Building distribution equipment and devices (existing or new) shall not be used without written permission of the Owner. If used for temporary power, the equipment shall be properly maintained and any damage resulting from use shall be repaired by the Contractor. The guarantee period for new equipment shall not begin until the equipment is turned over to the Owner.
- C. If AC power systems or their backup systems serving telecommunications, computer equipment, or their associated HVAC equipment and controls are taken out of service, for any reason, the Contractor shall be responsible for providing temporary systems during the period when the AC power systems or their backup systems are out of service. The Contractor shall be responsible for providing temporary power to all loads being interrupted.

1.14 SUBMITTALS:

A. General

- 1. Refer to the Conditions of the Contract (General and Supplementary), Division 1.
- 2. Contractor shall provide a submittal schedule appropriate for the size and schedule of the project. Limit the number of large submittals being reviewed at one time and coordinate timing of sections that are dependent on each other.
- 3. The Contractor shall identify any "long lead time" items which may impact the overall project schedule. If these submittal requirements affect the schedule, the Contractor shall identify the impacts and confer with the Engineer within two weeks of entering into the contract.
- 4. The front of each submittal package shall be identified with the specification section number, job name, Owner's project number, date, Prime Contractor and Subcontractor's names, addresses, and contact information, etc. Each Specification Section shall be

submitted individually and submittal shall be tabbed for the equipment/materials/etc. within the section. Submittals that are not complete with the required information will not be reviewed and will be sent back to be corrected.

- 5. Submittals shall be provided electronically. All electronic submittals need to be complete with all design information and stamped for conformity by the contractor. Submittals will be reviewed, marked appropriately and returned by the same means received.
- 6. An index shall be provided which includes:
 - a. Product
 - b. Plan Code (if applicable)
 - c. Specification Section
 - d. Manufacturer and Model Number
- 7. Submittal schedule shall be provided for review within four (4) working weeks from award of contract to successful bidder.
- B. Basis of Design: The manufacturer's material or equipment listed first in the specifications or on the drawings are the basis of design and are provided for the establishment of size, capacity, grade and quality. If alternates are used in lieu of the first names, the cost of any changes in construction required by their use shall be borne by this Contractor.
- C. All equipment shall conform to the State and/or local Energy Conservation Standards
- D. Contractor Review: Submittal of shop drawings, product data, and samples will be accepted only when submitted by the Contractor. Each submittal shall be reviewed by the contractor for general conformance with contract requirements and stamped by the respective contractor prior to submittal to the Architect/Engineer. Any submittal not stamped or complete will be sent back. Data submitted from subcontractors and material suppliers directly to the Architect/Engineer will not be processed unless written prior approval is obtained by the Contractor.
- E. Submittal Review Process: Before starting work, prepare and submit to the Architect/Engineer shop drawings and descriptive product data required for the project. Continue to submit in the stated format after each Architect/Engineer's action until a "No Exception Taken" or "Make Correction Noted" action is received. When a "Make Corrections Noted" is received, make the required corrections for inclusion in the operation and maintenance manual (O&M). Submittals marked "Make Corrections Noted" shall not be resubmitted during the submittal process. Unless each item is identified with specification section and sufficient data to identify its compliance with the specifications and drawings, the item will be returned "Revise and Resubmit". Where an entire submittal package is returned for action by the Contractor, the Engineer may summarize comments in letter format and return the entire set. Submittals shall be prepared per the ELECTRICAL SUBMITTAL CHECKLIST, at the end of this section; supplemental requirements are listed in each Division 26 Section.
- F. The Design Professional's review and appropriate action on all submittals and shop drawings is only for the limited purpose of checking for conformance with the design concept and the information expressed in the contract documents. This review shall not include:
 - 1. Accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes
 - 2. Construction means or methods
 - 3. Coordination of the work with other trades
 - 4. Construction safety precautions

- G. The Design Professional's review shall be conducted with reasonable promptness while allowing sufficient time in the Design Professional's judgment to permit adequate review. Review of a specific item shall not indicate that the Design Professional has reviewed the entire assembly of which the item is a component.
- H. The Design Professional shall not be responsible for any deviations from the contract documents not brought specifically to the attention of the Design Professional in writing by the Contractor. This shall clearly identify the design and the specific element which vary from the Design. The Contractor shall be responsible for all remedy for lack of strict conformance associated with this criteria.
- I. The Design Professional shall not be required to review partial submissions or those for which submissions of correlated items have not been received.
- J. If more than two submittals (either for product data, shop drawings, record drawings, test reports, or O&M's are made by the Contractor, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants. Such extra fees shall be deducted from payments by the Owner to the Contractor.
- K. The contractor shall cloud all changes made on submittals that are marked "Revise and Resubmit."
- L. Required Submittals: Provide submittals for each item of equipment specified or scheduled in the contract documents. See table at the end of this section.
- M. Submit proposed changes to electrical room or other equipment room layouts when revised from contract documents prior to installation.
- N. Mark submittals with designations as shown on the drawings and identify as required by Specification Sections. Identification shall contain the information as required in details and each label shall be submitted in list form with disconnects, MCC's, panelboards, switchboards, overcurrent protection devices and utilization equipment.

1.15 SPECIFIC CATEGORY SUBMITTAL REQUIREMENTS:

- A. Product Listing:
 - 1. Prepare listing of major electrical equipment and materials for the project, within (2) two weeks of signing the Contract Documents and transmit to the Architect
 - a. Provide all information requested.
 - 2. Unless otherwise specified, all materials and equipment shall be of domestic (USA) manufacture and shall be of the best quality used for the purpose in commercial practice.
 - 3. When two or more items of same material or equipment are required (lighting, wiring devices, switchgear, panelboards, protective devices, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials steel bar stock, welding rods, solder, fasteners, except as otherwise indicated.
 - a. Provide products which are compatible within systems and other connected items.
 - 4. For conduit, wire and fittings, the Contractor shall select a prime and alternate manufacturer from the list of acceptable manufacturers provided in the appropriate sections of this Division. The prime and alternate manufacturers shall be identified in the

product listing. The contractor shall make every effort to use the prime manufacturer for the entire project. If products from this manufacturer are unavailable, the Contractor shall use the listed alternate with the following provisions.

- a. Wire: All wire placed in a single conduit or installed in multiple conduits making up parallel feeders shall be of the same manufacturer.
- b. Conduit and Fittings: All conduits and fittings installed exposed within the same room or immediate area shall be of the same manufacturer.
- B. Schedule of Values
 - 1. Provide Preliminary Schedule of Values to Engineer with product data submittal within four (4) weeks from award of contract to successful bidder. Provide according to the following descriptions:
 - a. General Construction (total)
 - b. Demolition
 - c. Lighting
 - d. Lighting Controls
 - e. Basic Materials/Devices/Equipment Connections (Mechanical)
 - f. Fire Alarm (Material/Installation)
 - g. Security
 - 2. Provide a final Schedule of Values at close-out of project including updated values based on actual installation.
- C. Product Data:
 - 1. Where pre-printed data covers more than one distinct product, size, type, material, trim, accessory group or other variation, mark submitted copy with black pen to indicate which of the variations is to be provided.
 - 2. Delete or mark-out portions of pre-printed data which are not applicable.
 - 3. Where operating ranges are shown, mark data to show portion of range required for project application.
 - 4. For each product, include the following:
 - a. Sizes.
 - b. Weights.
 - c. Speeds.
 - d. Capacities.
 - e. Conduit and electrical connection sizes and locations.
 - f. Statements of compliance with the required standards and regulations.
 - g. Performance data.
 - h. Manufacturer's specifications.
 - i. Housing and proposed Finishes.
 - j. NEMA or other ratings that apply.
 - 5. Checklist: Where identified in ELECTRICAL SUBMITTAL CHECKLIST or within individual Division 26 Sections or necessary for confirmation of products, submit a detailed checklist which acknowledges compliance or a reason for non-compliance to each of the specification requirements. Arrange the checklist according to the headings of each item identified in each specification (i.e. Shop Drawings, Wiring Diagrams, Product requirements, individual line items, etc.) Mark items as "N/A" where the item is not applicable.

- D. Shop Drawings:
 - 1. Shop Drawings are defined as electrical system layout drawings prepared specifically for this project, or fabrication and assembly type drawings of system components to show more detail than typical pre-printed materials.
 - 2. Prepare Electrical Shop Drawings, except diagrams, to accurate scale, min 1/8"-1'-0", Electrical rooms shall be 1/4"-1'-0" unless otherwise noted.
 - 3. Shop drawings shall include:
 - a. Proposed equipment installations.
 - b. Electrical characteristics and connection requirements.
 - c. Clearance dimensions at critical locations.
 - d. Dimensions of spaces required for operation and maintenance.
 - e. Interfaces with other work, including structural support.
 - f. Elevations when necessary in areas with multiple pieces of equipment on common walls or to clarify incoming/exiting methods/clearances, etc.
 - g. Wall and floor penetrations.
 - h. Wiring diagrams shall showing all components, internal connecting wiring, and contractor connection requirements including terminal blocks/lugs, wire sizes, etc.
- E. Test Reports:
 - 1. Submit test reports which have been signed and dated by the accredited firm or testing agency performing the test.
 - 2. Prepare test reports in the manner specified in the standard or regulation governing the test procedure (if any) as indicated.
 - 3. Submit test reports as required for O & M manuals.
- F. Operation and Maintenance Data: See separate paragraph of this specification section.
- G. Equipment Settings Report: Where identified in the ELECTRICAL SUBMITTAL CHECKLIST or within individual Division 26 Sections or necessary for confirmation of products, submit Equipment Settings Report for each device indicating final configurations and settings.
 - 1. Provide report of settings, parameters, programing inputs and parameters, etc., installed at each piece of electrical equipment that allows adjustments to be made in the field and those set at the factory. The report shall be arranged by specification section and each piece of equipment broken out individually or by listing of equipment if the same settings are installed in multiple pieces of equipment.
 - 2. In addition to the requirements above, include within this report any individual ground fault system settings; zone interlock operational settings; Arc Flash reduction schemes and levels; transfer switch settings including time delays and upstream protection device settings with copies of listed OCPD's for each ATS; settings of monitoring equipment including trip levels and alarm levels; Generator settings; phase rotation documentation; lighting control settings with associated timer settings; electrical interlock and/or kirk key system descriptions; posted operational signage; and any other pertinent information.
 - 3. Report shall be submitted and received by the Engineer at least fifteen calendar days prior to the contractor's request for final observation. Include in the O & M Manual after review and "No Exceptions Taken" has been accomplished.
 - H. Software Licenses: Provide documentation of ownership under the owner's corporate name (coordinate with owner's representative for exact ownership wording) for Software Licenses provided as part of the work. Include information for updates, subscription requirements if applicable, backup, support, login, passwords, date when purchased,

expiration date if applicable, version, etc. Include in the O & M Manual after review and "No Exceptions Taken" has been accomplished.

I. Record Drawings: See separate paragraph of this specification section.

1.16 DELIVERY, STORAGE AND HANDLING:

- A. Refer to the Division 1, Sections on Transportation and Handling and Storage and Protection.
- B. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
- C. Check delivered equipment against contract documents and submittals.
- D. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage and weather.
- E. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installations.

1.17 DEMOLITION/REMODEL WORK:

- A. Refer to Division 1 Section on Summary of work for requirements on working in Owneroccupied areas of the existing building and Division 2 section on selective demolition. The following paragraphs supplement the requirements of other Divisions.
- B. During the demolition phase of this contract it is the responsibility of this Contractor to carefully remove existing equipment, conduits, boxes, and related items either as shown on the demolition drawings as being removed, or as required for the work. These items shall be tagged, protected from damage and stored as directed by the Owner. A list of all items stored shall be turned over to the Architect/Engineer. At the completion of the remodeling work or when directed by the Architect, all stored items not reused or wanted by the Owner shall be removed from the premises.
- C. The project involves renovation and remodel of the existing building. On the drawings, work may be denoted by showing items as bold or light line weight and certain renovation symbols are used. These indications and symbols are amplified as follows:
 - 1. Bold Print (when used): Work included in this contract is denoted in bold print or darker line weight.
 - 2. Light Print (when used): Work shown lightly indicates existing conditions to remain.
 - R = Existing item to be removed. Contractor shall remove the existing item and the associated existing wiring. Where the raceway serving the equipment is accessible (via removal of suspended ceiling, crawl space, etc.) the raceway shall also be removed. Where the removal of a raceway leaves visible evidence on an existing surface which is not being repaired or replaced by the General Contractor, this contractor shall repair the surface. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover-plate installed. Where the concealed raceway is uncovered by demolition performed by the General Contractor, the raceway shall be removed (or extended to new location if appropriate).

E =Existing item to remain, may necessitate removal and reinstallation to facilitate new work, maintain circuit continuity. Contractor shall perform the following function based upon the item to remain:

Luminaires	-	Remove only if required for new work and clean and reinstall.
Switches	-	Remove devices only if required for new work and clean and reinstall.
Receptacles	-	Remove devices only if required for new work and clean and reinstall.

- Clock Clean and reinstall.
 - ER = Existing item to remain, Replace device, maintain circuit continuity. Contractor shall perform the following function based upon the item to remain:

Luminaires	-	Clean and install new lamps.
Switches	-	Remove and replace with new in

Switches - Remove and replace with new in existing box.

Receptacles - Remove and replace with new in existing box.

Clock - Remove and replace with new in existing box.

RL = Existing item to be Relocated. Contractor shall remove the existing item, and store in a safe place. The existing item shall be relocated to the new position as called for on the drawings. At Contractor's option, the existing wiring may be extended (unused boxes shall be removed and conduit and wiring extended from nearest concealed box unless specifically noted otherwise), or new wiring may be run from the source. Based upon the item to be relocated, the Contractor shall perform the following function:

Luminaires	-	Clean and reinstall in new location.
Receptacles	-	Clean and reinstall in new location.
Clocks	-	Clean and reinstall in new location.

- RR = Remove and Reinstall. Existing item to be Removed and Reinstalled to facilitate new work.
- D. Existing equipment that is removed and not scheduled to be reused shall remain the property of the Owner and be delivered for disposition unless specifically indicated otherwise and shall be stored in a location designated by the Owner. Items which are removed and not wanted by the Owner shall become the property of the Contractor and shall be removed from the site.
- E. Existing equipment that is removed and is to be reused shall be cleaned, serviced and operable before being reinstalled.
- F. Revise panelboard schedules to reflect removal or relocation of equipment. Circuit integrity of equipment in adjacent areas shall be left intact.
- G. Where remodeling interferes with existing circuits and equipment which are not to be removed, such circuits and equipment shall be reworked and relocated as required to complete the project.
- H. The Contractor shall remove all distribution equipment, conductors, etc., which are indicated to be removed or which must be removed to accommodate demolition. Equipment to be removed may require reworking conduit and wiring in order to maintain service to other equipment.

- I. Where remodeling interferes with circuits serving areas outside of the project or phase limits or which are remodeled in later phases of the project, circuits shall be reworked or temporary circuits provided as required.
- J. Existing equipment and circuiting shown are based on field surveys and/or Owner furnished drawings. The Contractor shall verify conditions as they exist with necessary adjustments being made to the drawing information.
- K. Coordinate the routing of all conduits with the existing mechanical and plumbing systems in order to avoid conflicts with ducts, pipes, etc. Where existing electrical boxes, conduit, or equipment interfere with installation of new ducts, plumbing, walls, soffits, luminaires, outlets, etc., the Contractor shall resolve the conflict with the appropriate trade.
- L. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated on the drawings or allowed under the appropriate section of the specifications.
- M. Electrical Outages: Electrical outages must be held to a minimum. The Contractor shall submit a Method of Procedure (MOP) for each outage to the Owner, detailing the reasons for the outage, areas affected, sequence of procedures to accomplish work, estimated maximum length of time along with the date and time of day outage will occur. The Contractor shall meet with the Owner to set a schedule and date for the outage based on the MOP. Due to the critical implications of power outages, the Owner may direct the Contractor as to the time of day or night and date an outage may take place.
 - 1. The Contractor will be responsible for providing temporary power required for the duration of the outages. The required outages to connect and disconnect the temporary power will require a MOP as described above.
 - 2. Log each approved and implemented MOP and submit with O&M Manuals.
- N. PCB Ballasts: PCB type ballasts may be present in existing luminaires. If PCB ballasts are discovered by the Contractor, report such occurrence to the Owner immediately. The Contractor shall remove and dispose of PCB type ballasts at an E.P.A. (Environmental Protection Agency) approved site in the prescribed manner acceptable to the EPA. The Contractor shall pay all fees associated with this work.
- O. Hazardous Material: If suspected hazardous material, in any form, is discovered by this Contractor in the process of his work, he shall report such occurrence to the Owner immediately. The Owner will determine the action to be taken. Hazardous material removed is not a part of the work to be done under this Division.
- P. Lamp Disposal: Contractor is responsible for sending removed lamps to be recycled. The Contractor should ensure the recycling agency meets RCRA and CERCLA regulations. Provide certificate of compliance in O&M Manuals.
- Q. On Site Metering: When called for in the specifications or on the drawings, the Contractor shall meter the points indicated for a period of 30 days prior to start of construction to verify existing load. Meter shall record voltage; amperage; KVA; and Power Factor for each phase and sum of the phases. The meter shall continually average the power demand over maximum 15 minute intervals as required by NEC 220.87. Compile a metering summary report and deliver results to engineer after 7 days and after 30 days. Verify existing loads at and downstream of the metering location and provide list to engineer of what loads are not on during the 30 day metering and the reason why. Organize list by equipment name. If any loads have been removed or permanently abandoned, Turn circuit breaker off and relabel as SPARE.

1.18 CUTTING AND PATCHING:

- A. Cutting and patching of electrical equipment, components, and materials may be required for removal and legal disposal of selected materials, components, and equipment. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- B. Refer to the Division 1 Section covering cutting and patching for general requirements.
- C. Do not endanger or damage installed Work through procedures and processes of cutting and patching.
- D. Arrange for repairs required to restore other work, because of damage caused as a result of electrical installations.
- E. No additional compensation will be authorized for cutting and patching Work that is necessitated by ill-timed, defective, or non-conforming installations.
- F. Perform cutting, fitting, and patching of electrical equipment and materials required to:
 - 1. Uncover Work to provide for installation of ill-timed Work;
 - 2. Remove and replace defective Work;
 - 3. Remove and replace Work not conforming to requirements of the Contract Documents;
 - 4. Remove samples of installed Work as specified for testing;
 - 5. Install equipment and materials in existing structures;
 - 6. Upon written instructions from the Architect/Engineer, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.
- G. Cut, remove and legally dispose of selected electrical equipment, components, and materials as indicated, including, but not limited to removal of conductors, conduit, luminaires, boxes, devices and other electrical items made obsolete by the new Work.
- H. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- I. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- J. Locate, identify, and protect electrical services passing through remodel or demolition area and serving other areas required to be maintained operational.
- K. When coring is required or identified, an x-ray of the area is to be taken prior to the performance of the work operation. X-ray work requires an MOP and protection.
- 1.19 ROUGH-IN:
 - A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
 - B. Refer to equipment shop drawings and manufacturer's requirements for actual provided equipment for rough in requirements.
 - C. Work through all coordination before rough-in begins.

1.20 ACCESSIBILITY:

- A. Install equipment and materials to provide required code clearances and access for servicing and maintenance. Coordinate the final location with piping, ducts, and equipment of other trades to insure proper access for all trades. Coordinate locations of concealed equipment, disconnects, and boxes with access panels and doors. Allow ample space for removal of parts, fuses, lamps, etc. that require replacement or servicing.
- B. Extend all conduits so that junction and pull boxes are in accessible locations.
- C. Provide access panel or doors where equipment or boxes are concealed behind finished surfaces.
- D. Furnish hinged steel access doors with concealed latch, whether shown on drawings or not, in all walls and ceilings for access to all concealed valves, shock absorbers, air vents, motors, fans, balancing cocks, and other operating devices requiring adjustment or servicing. Refer to Division 1 for access door specification and requirements.
- E. The minimum size of any access door shall not be less than the size of the equipment to be removed or 12 inches x 12 inches if used for service only.
- F. Furnish doors to trades performing work in which they are to be built, in ample time for building in as the work progresses. Whenever possible, group valves, cocks, etc., to permit use of minimum number of access doors within a given room or space.
- G. Factory manufactured doors shall be of a type compatible with the finish in which they are to be installed. In lieu of these doors, approved shop fabricated access doors with DuroDyne hinges may be used.
- H. Access doors in fire rated walls and ceilings shall have equivalent U.L. label and fire rating.

1.21 TESTING:

- A. Submit test reports as outlined in Division 1 Sections on Quality Control Services and each Division 26 Section.
- B. Testing as required by these specifications shall pertain to all equipment, wiring, devices, etc. installed under this contract and being reused.
- C. General Scope:
 - 1. Perform all tests and operational checks to assure that all electrical equipment, both Contractor and Owner-supplied, is operational within industry and manufacturer's tolerances and is installed in accordance with design specifications.
 - 2. The tests and operational checks shall determine the suitability for energization.
 - 3. Schedule tests and give a minimum of two weeks advance notice to the Architect/Engineer. Reschedule testing for Owner convenience if required.
- D. Test Report: Submit the completed report to the Architect/Engineer no later than fifteen (15) days after completion of test unless directed otherwise. The test report shall be bound and its contents certified. A final compilation of all Test Reports shall be submitted with the Testing and Equipment Settings Report (Refer to Operation and Maintenance Data paragraphs).

- E. Each test report shall include the following:
 - 1. Project information including: Building, name, address, date, and other pertinent information.
 - 2. List of equipment tested.
 - 3. Description of test.
 - 4. List of test equipment used and calibration date.
 - 5. Baseline, acceptable, or published target value for test with code or standard reference indicating where value was derived.
 - 6. Test results that summarize all measured values with baseline values.
 - 7. Conclusions and recommendations.
 - 8. Appendix, including appropriate test forms that show all measured values.
- F. Failure to Meet Test:
 - 1. Any system material or workmanship which is found defective on the basis of performance tests shall be reported directly to the Architect/Engineer.
 - 2. All failed tests shall be sent immediately by email to Architect/Engineer with proposed corrective action and proposed re-test date and time.
 - 3. Contractor shall replace the defective material or equipment as necessary, and have test repeated until test proves satisfactory without additional cost to the Owner.

1.22 CLEANING:

- A. Refer to the Division 1 Section on project closeout or final cleaning for general requirements for final cleaning.
- B. Clean all luminaires, lamps and lenses per manufacturer's recommendations prior to final acceptance. Replace all inoperative lamps.

1.23 RECORD DOCUMENTS:

- A. Refer to the Division 1 Section on Project Closeout or Project Record Documents for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Keep a complete set of record document prints in custody during entire period of construction at the construction site. Documents shall be updated on a weekly basis.
- C. Mark Drawings to indicate revisions to conduit size and location both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; concealed control system devices, and any other relevant deviations from the Contract Documents.
- D. Mark shop drawings to indicate approved substitutions; Addenda; Change Orders; actual equipment and materials used.
- E. Schedules:
 - 1. Mark luminaire schedule on drawings to indicate manufacturer and complete catalog numbers of installed equipment.

- 2. Mark schedules including panelboard, switchboard, motor control center, mechanical, kitchen and similar equipment schedules on drawings to indicate installed equipment and materials used, and any deviations or revisions to electrical load data and calculations.
- F. Revisions to the Contract Documents shall be legible and shall be prepared using the following color scheme.
 - 1. Red shall indicate new items, deviations and routing.
 - 2. Green shall indicate items removed or deleted.
 - 3. Blue shall be used for relevant notes and descriptions.
- G. At the completion of the project, obtain from the Architect a complete set of the Contract Documents in a read-only electronic format (.pdf unless otherwise noted). This set will include all revisions officially documented through the Architect/Engineer. Using the above color scheme, transfer any undocumented revisions from the construction site record drawings to this complete set. Submit marked up and completed documents to the Architect/Engineer. This contract will not be considered completed until these record documents have been received and reviewed by the Architect/Engineer.
- H. Contractor may propose methods of maintaining record documents on electronic media. Obtain approval of Engineer and Owner prior to proceeding. Marked-up .pdf format readable by Bluebeam is preferred.

1.24 OPERATION AND MAINTENANCE DATA:

- A. Refer to the Division 1 Section on project closeout or operation and maintenance data for procedures and requirements for preparation and submittal of maintenance manuals.
- B. No later than four (4) weeks prior to the completion of the project provide complete set of operating and maintenance manuals, or as specified in Sections of Division 1 (whichever is more stringent). Operation and Maintenance Data shall be submitted in electronic format.
- C. Operation and Maintenance Data: Submit operation and maintenance data in maintenance manual in accordance with requirements of applicable Division 26 Sections and Division 1. Provide Operating and Maintenance Instructions in electronic format covering all equipment furnished. Manuals shall include all information required below, as indicated in each Division 26 Section, and the following for each piece of equipment:
 - 1. The job name and address, contractor's name, address, and phone number, and each subcontractor's name, address, and phone number shall be identified at the front of the electronic submittal.
 - 2. Name, address and telephone number to be contacted of the local authorized service organization/company and individual to be contacted for service and maintenance for each item of equipment.
 - 3. Submit operation and maintenance data, schedule of recommended service and parts lists for all materials and products specified and intended for installation. Include description of function, normal operating characteristics and limitations, fuse curves, engineering data and tests, and complete nomenclature and commercial numbers of all replaceable parts.
 - 4. Manufacturer's printed operating procedures to include start-up, break-in, routine and normal operating instructions; regulation, control, stopping, shut-down, and emergency instructions; and summer and winter operating instructions.

- 5. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
- 6. Servicing instructions and lubrication charts and schedules.
- 7. Manufacturer's service manuals for all electrical equipment provided under this contract.
- 8. Complete equipment and protection wiring diagrams. All wiring diagrams shall show color coding of all connections and mounting dimensions of equipment.
- 9. Equipment identification numbers and adjustment clearly indicated for each piece of equipment.
- 10. Electrical System and Equipment Warranties.
- 11. Provide manuals tabbed and divided into major sections and special equipment. Mark the individual equipment when more than one model or make is listed on a page. Provide detailed table of contents.
- 12. Record Set of Shop Drawings: Shop drawings corrected to show as-built conditions. Transfer modifications from field set.
- 13. Equipment Testing Report including all test reports and Equipment Settings Report indicating final configurations and settings.
- D. This contract will not be considered completed nor will final payment be made until all specified material, including test reports, settings reports, and final Schedule of Values with all Electrical and Information Technology change order costs included and identified is provided and the manual is reviewed by the Architect/Engineer.

1.25 PROJECT CLOSEOUT LIST:

- A. In addition to the requirements specified in Division 1, complete the requirements listed below.
 - 1. The contractor shall be responsible for providing the items listed on the Electrical Submittal Checklist prior to applying for certification of substantial completion. Refer to individual specification sections for additional requirements (Checklist is located at the end of this section.)
 - 2. Final payment will not be authorized until all items on the final punch list have been complete.

1.26 WARRANTIES:

- A. Refer to the Division 1 Section on Warranties and Bonds for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements. In no case shall the warranty for the total electrical system be less than one year from date of acceptance by the Owner.
- B. Compile and assemble the warranties specified in Division 26, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item. Information to include product or equipment description, date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.
1.27 CONSTRUCTION REQUIREMENTS:

- A. The contractor shall maintain and have available at the jobsite current information on the following at all times:
 - 1. Up to date record drawings.
 - 2. Addenda
 - 3. Change Orders
 - 4. Submittals
 - 5. Site observation reports with current status of all action items.
 - 6. Test results; including recorded values, procedures, and other findings.
 - 7. Outage information.

1.28 ELECTRICAL SUBMITTAL CHECKLIST:

A. Provide submittals including shop drawings, product data, product checklists, tests and reports, training, extra material, record drawings, O&M manuals, device setting reports, and software licenses per the following schedule:

Division 26

C - Product Checklist; Q - Qualifications, RD - Record Drawings, D - Device Setting Report; S - Software License, W - Special Project Warranty Requirements SPEC Report Data Factory Rep Other TITLE Training Extra Factory Section Report Supervision O&M Shop Product Test Test Req'd at Site Material at Site Drawings Data Common Work Results For 26 05 00 Electrical **Electrical Coordination** Х Drawings Existing Conditions Survey Х Drawings Seismic Design Parameters Х Х Х Х per Local Authority **Temporary Facilities** Х Х Х Product Listing Х Х С Preliminary Schedule Of Х Values Final Schedule Of Values х Х Lamp disposal Certificates Х Х Х /PCB/Hazardous Material Electrical On-Site Metering Х Х Х Reports Testing Х Х Х Х Х Х Х Х D Completed/Signed MOP's Х Х Record Drawings including Х Х changes to existing Equip. Х Х **O&M** Manuals Х Х Х Х Х C,D,S Project Closeout List Х Х Contractor/Equipment Х Х Warranties

C – Prod	uct Checklist; Q – Qualificatio	ons, RD - Re	ecord Drawir	ngs, D – [Device Set	ting Repo	ort; S – Softwa	ire License, W -	– Special F	Project Wa	arranty	
	TITLE	Requirements										
SPEC Section		Report Data			Factory		Factory Rep	Training	Extra		Other	
		Shop Drawings	Product Data	Test	Test	Report	Supervision at Site	Req'd at Site	Material	O&M		
26 05 19	Low Voltage Electrical Power Conductors And Cables		х	х		х				х		
26 05 29	Hangers And Supports For Electrical Systems	х	х							х		
26 05 33	Raceway And Boxes For Electrical Systems	х	Х								RD	
	Electrical Metallic Tubing		х								RD	
	Flexible Metal Conduit		х								RD	
	Liquid-Tight Flexible Conduit		х								RD	
	Non-Metallic Conduit PVC		х								RD	
	Rigid Metal Conduit		х								RD	
	Surface Metal Raceway	х	х							х	RD	
	Wireways	х	х							х	RD	
26 05 34	Cabinets, Boxes & Fittings	х	х								RD	
26 05 53	Identification For Electrical Systems	Х	Х							х		
26 05 83	Wiring Connections	х	х	х							D	
26 09 23	Lighting Control Devices	Х	х	х		х	х	х	х	Х	C, RD,,D,S	
26 27 26	Wiring Devices		х	х		х				х		
26 28 00	Low Voltage Circuit Protective Devices	x	х	x		x		х	x	x	C, D.S	
26 50 00	Lighting	х	х	Х		Х			Х	х		
	Ballasts, LED's, Drivers	Х	х	х		х				Х	W	
28 31 11	Fire Detection and Alarm	х	х	х		х	х	х		Х	C, Q, S	

END SECTION 260500

SECTION 260519 - LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY:

A. This section includes wires, cables, and connectors for power, lighting, signal, control, and related systems rated 600 volts and less.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. Conform to applicable code regulations regarding toxicity of combustion products of insulating materials.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's data on electrical wires, cables and connectors.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver wire and cable properly packaged in factory- fabricated type containers, or wound on NEMA-specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 - PRODUCTS

- 2.1 ACCEPTABLE MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following (for each type of wire, cable, and connector):

- 1. Wire and Cable:
 - a. Belden
 - b. Cerrowire
 - c. Encore Wire
 - d. General Cable Corporation.
 - e. Southwire Company
 - f. Okonite
 - g. Superior Essex
- 2. Connectors:
 - a. Emerson
 - b. AMP, Inc.
 - c. Burndy Corporation.
 - d. Ideal Industries, Inc.
 - e. 3M Company
 - f. ABB

2.2 WIRES AND CABLES:

- A. General: Provide wire and cable suitable for the temperature, conditions, and location where installed.
- B. Conductors: Provide solid conductors and approved connectors for power, control, and lighting circuits 10 AWG and smaller. Provide stranded conductors for 8 AWG and larger.
- C. Conductor Material: Provide copper for all wires and cables.
 - 1. Metal Clad Cable Type MC: Sizes 12 AWG and 10 AWG, copper conductors with 600 volt thermoplastic insulation rated 90 degrees C, aluminum interlocked metal type covering. Fitting shall be steel with double grip saddle and locking nut.
 - 2. Portable Cord:
 - a. Type SO: Sizes 12 AWG through 2 AWG, copper conductors with 600 volt thermoset insulation 0.1 resistant insulation.
 - b. Type G-GC: Sizes 1 AWG through 500 KCMIL, copper conductors with 600/2000 volt, 90 degrees C, ethylene-propylene insulation.
 - 3. Cables: Provide the following types of cables in NEC approved locations and applications where permitted by the contract documents. Cables shall be U.L. listed and approved by the local building authority. All cables shall contain a green insulated equipment ground conductor of the same size as the neutral conductor.

2.3 CONNECTORS:

- A. Description: Provide UL-type factory-fabricated, solderless metal connectors of sizes, ampacity ratings, materials, types and classes for applications and for services indicated. Use connectors with temperatures equal to or greater than those of the wires upon which used.
- B. Provide 2-hole compression lugs for all power feeder, neutral, and grounding connections when installed on bus bars. (Including phase, neutral and grounding conductors).

C. Provide connectors that are designed to accept stranded conductors where stranded conductors are used.

PART 3 - EXECUTION

- 3.1 WIRE AND CABLE INSTALLATION SCHEDULE:
 - A. Building Wire: Install all building wire in raceway regardless of location.
 - B. Metal Clad Cable:
 - 1. Maximum of 6 feet unsupported length for connecting luminaires in accessible ceilings to the local junction box.
 - 2. Maximum of 6 feet unsupported length for connecting luminaires in non-accessible ceilings to the local junction box.
 - 3. Branch circuit conductors shall match color coding schedule within this specification section.
 - C. Portable Cord: Use for flexible pendant leads to luminaires, outlets, and equipment where indicated and in compliance with codes.

3.2 INSTALLATION OF WIRES AND CABLES:

- A. General: Install electrical cables, wires and connectors in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Coordinate wire/cable installation work, including electrical raceway and equipment connection work, with other work.
- C. Pull conductors simultaneously where more than one is being installed in same raceway. Use pulling compound or lubricant, where necessary; compound used must not deteriorate conductor or insulation.
- D. Use pulling means including, fish tape, cable, rope and basket weave wire/cable grips which will not damage cables or raceway. Do not use rope hitches for pulling attachment to wire or cable.
- E. Keep conductor splices to minimum. Splice only in accessible junction boxes. No splices are allowed in feeder, control or fire alarm wiring. Connect unspliced wire to numbered terminal strips at each end.
- F. Install splices and taps which possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
- G. Use splice and tap connectors which are compatible with conductor material.
- H. Tighten electrical connectors and terminals, including screws and bolts, in accordance with manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A.
- I. Support cables above accessible ceilings. Independent from the ceiling suspension system to support cables from structure, do not rest on ceiling tiles.

- J. Provide adequate length of conductors within electrical enclosures and train the conductors to terminal points with no excess. Bundle multiple conductors, with conductors larger than No. 10 AWG cabled to individual circuits. Make terminations so there is no bare conductor at the terminal.
- K. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and larger. For 10 AWG and smaller, use insulated screw on type spring wire connectors with plastic caps, push on type are not acceptable.
- L. Use copper compression connectors for copper wire splices and taps, 1/0 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of the conductor.
- M. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- N. Thoroughly tape the ends of spare conductors in boxes and cabinets.
- O. Install exposed cable, parallel and perpendicular to surfaces, or exposed structural members, and follow surface contours, where possible.
- P. Make all ground, neutral and line connections to receptacle and wiring device terminals as recommended by manufacturer. Provide ground jumper from outlet box to individual ground terminal of devices.
- Q. Branch circuits whose length from panel to first outlet exceeds 100 feet for 120 volt circuits or 175 feet for 277 volt circuit shall be #10 or larger, as required to comply with the National Electrical Code.
- R. Parallel conductors shall be cut to the same length.
- S. All splices in control panels, terminal junction boxes, low voltage control circuits, fire alarm, etc., conductors shall be on numbered terminal strip.
- T. Where conduit is not required, plenum rated cable shall be provided in ceiling, floor or other air plenum spaces.
- U. Provide wire training, lacing, labeling, and terminal blocks as required in panelboards and all control cabinets including, but not limited to, lighting, transfer switch, fire alarm, and security cabinets. All wiring shall be installed neat and be labeled to match wiring diagrams, control devices, etc.
 - 1. Make temporary connections to panelboard devices with sufficient slack conductor to facilitate reconnections required for balancing loads between phases.
- V. Color coding of switch legs, travelers, etc. shall be different and distinct from phase and neutral conductors. Where systems utilize two (2) different voltages, the color coding of switch legs, travelers, etc. shall be different and distinct for each voltage system.

3.3 FIELD QUALITY CONTROL:

A. Test installed wires and cables with 1000 VDC megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. Test shall be made on all feeders regardless of size and on all branch circuits with No. 4 AWG and larger conductors. The

megger values obtained shall be compared to the minimum values listed in NETA. All phase conductors and cables shall be meggered after installation, and prior to termination. Submit test report.

- B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

3.4 COLOR CODING SCHEDULE:

A. Match existing color coding present in building. Otherwise, color code secondary service, feeder, and branch circuit conductors as follows: 120/208 Volts Phase 277/480 Volts

120/208 Volts	<u>Phase</u>	<u>277/480 \</u>
Black Red Blue	A B C	Brown Orange Yellow
Green	Ground	Green

- B. Conductors shall be solid color for entire length.
- C. If solid color conductor insulation is not available and specific acceptance is given by the engineer for use of black conductor insulation, provide the following:
 - 1. Conductors 6 AWG and smaller shall be solid color for the entire length.
 - 2. Conductors 4 AWG and larger shall have either solid color insulation as specified above for the entire length or be black with color coding at each termination and in each box or enclosure. For a distance of 6 inches use half-lapped ³/₄ inch plastic tape in the above specified color. Do not cover cable identification markings. Adjust tape locations to prevent covering of markings.

3.5 METAL CLAD WIRING INSTALLATION:

- A. The location of system components, including cable routing shown on the plans, are approximate. Use good judgment in their placement to eliminate all interference with ducts, piping, etc.
- B. All cable routing shall be done in a neat and workmanlike manner, consistent with recognized good practice and in accordance with the manufacturer's instructions.
- C. Route the cables along the grid system. Do not route cables diagonally or in any way which restricts removal of lay-in ceiling material.
- D. Support cable on ceiling wires adjacent to each luminaire and at four foot intervals using clamp supports manufactured specifically for that purpose.

END OF SECTION 260519

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SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

A. This Section includes secure support from the building structure for electrical items by means of hangers, supports, anchors, sleeves, inserts, seals, and associated fastenings.

1.2 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product data for each type of product specified.
 - 1. Hanger and support schedule showing manufacturer's figure number, size, spacing, features, and application for each required type of hanger, support, sleeve, seal, and fastener to be used.
- C. Shop drawings indicating details of fabricated products and materials.
- D. Engineered Design consisting of details and engineering analysis for supports for the following items:
 - 1. Trapeze hangers for multiple conduit runs.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Slotted Metal Angle and U-Channel Systems:
 - a. Allied Tube & Conduit
 - b. B-Line Systems, Inc.
 - c. Unistrut Diversified Products
 - 2. Conduit Sealing Bushings:
 - a. O-Z/Gedney
 - b. Cooper Industries, Inc.
 - c. Killark Electric Mfg. Co.
 - d. Madison Equipment Co.
 - e. Raco, Inc.
 - f. Spring City Electrical Mfg. Co.
 - g. Thomas & Betts Corp.

2.2 COATINGS:

A. Coating: Supports, support hardware, and fasteners shall be protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic. Products for use outdoors shall be hot-dip galvanized.

2.3 MANUFACTURED SUPPORTING DEVICES:

- A. Raceway Supports: Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
- B. Fasteners: Types, materials, and construction features as follows:
 - 1. Expansion Anchors: Carbon steel wedge or sleeve type.
 - 2. Toggle Bolts: All steel springhead type.
 - 3. Powder-Driven Threaded Studs: Heat-treated steel, designed specifically for the intended service.
- C. Conduit Sealing Bushings: Factory-fabricated watertight conduit sealing bushing assemblies suitable for sealing around conduit, or tubing passing through concrete floors and walls. Construct seals with steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.
- D. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.
- E. U-Channel Systems: 12-gage steel channels, with 9/16 inch-diameter holes, at a minimum of 8 inches on center, in top surface. Provide fittings and accessories that mate and match with U-channel and are of the same manufacture.
- F. Supports: Provide supporting devices of types, sizes and materials indicated; and having the following construction features:
 - 1. One-Hole Conduit Straps: For supporting 1 inch and smaller rigid metal conduit; galvanized steel.
 - 2. Two-Hole Conduit Straps: For supporting 1 inch and larger rigid metal conduit, galvanized steel; ¾ inch strap width; and 2-1/8 inch between center of screw holes.

2.4 FABRICATED SUPPORTING DEVICES:

- A. General: Shop- or field-fabricated supports or manufactured supports assembled from U-channel components.
- B. Steel Brackets: Fabricated of angles, channels, and other standard structural shapes. Connect with welds and machine bolts to form rigid supports.

- C. Pipe Sleeves: Provide pipe sleeves of one of the following:
 - 1. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe.
 - 2. EMT, IMC, or Rigid Conduit.

2.5 FIRE SEALS:

- A. Material: Fire stopping material shall be asbestos free, 100 percent intumescent, have code approval under BOCA, ICBO, SSBC, NFPA 101, NFPA 70, and be capable of maintaining an effective barrier against flame and gases in compliance with the following requirements.
- B. Flame Spread: 25 or less, ASTM E84
- Fire Resistance and Hose Stream Tests: Fire stopping materials shall be rated "F" and "T" in accordance with ASTM E 814 or UL 1479. Rating periods shall conform to the following:
 (F) 3 (T) 3 Time-rated floor or wall assemblies.
 - (F) 3 (T) 3 Openings between floor slabs and curtain wall.
- D. Manufacturers: Subject to compliance with requirements, provide fire seals of the following:
 - 1. 3M Company
 - 2. STI
 - 3. Tremco
 - 4. Hilti

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Install supporting devices to fasten electrical components securely and permanently in accordance with NEC requirements.
- B. Coordinate with the building structural system and with other electrical installation.
- C. Junction Box Supports: Comply with the NEC and the following requirement:
 - 1. Use ¹/₄" all-thread rod from structure to support junction boxes.
- D. Raceway Supports: Comply with the NEC and the following requirements:
 - 1. Conform to manufacturer's recommendations for selection and installation of supports.
 - 2. Strength of each support shall be adequate to carry present and future load multiplied by a safety factor of at least four. Where this determination results in a safety allowance of less than 200 lbs., provide additional strength until there is a minimum of 200 lbs. safety allowance in the strength of each support.
 - 3. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.

- 4. Use #9 ceiling wire to support individual conduits up to 3/4inch with spring steel fasteners. Use of ceiling support wires is unacceptable.
- 5. Support parallel runs of horizontal raceways together on trapeze-type hangers. Use 3/8 inch diameter or larger threaded steel rods for support.
- 6. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners may be used in lieu of hangers only for 1-1/2 inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings only. For hanger rods with spring steel fasteners, use ¼ inch-diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing. For hanger rods supporting 1-1/2 inch or larger conduits provide 3/8 inch minimum threaded steel rods with pipe hangers.
- 7. Space supports for raceways in accordance with NEC. When there are 4 or more 2 inch conduits in a trapeze, supports shall be spaced 5 feet O.C.
- 8. In all runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on raceway terminals.
- 9. Threaded rod supports to have bottoms cut off at a maximum length equal to rod diameter below bottom nut.
- 10. Attachment of electrical supports to piping, ductwork, mechanical equipment or conduit is not allowed.
- E. Conductor or Cable Supports: Comply with the NEC and the following requirements:
 - 1. Support individual conductors or cables by separate clamps with rubber or plastic grommet, fasten using a non-metallic bolt and nut, and secure clamps to unistrut supports anchored to structure (multiple clamps may be secured to a single unistrut support). Individual conductors or cables may be served utilizing a vinyl or fiberglass clamp which shall be anchored to the structure.
 - 2. Space supports as follows:
 - a. Horizontal conductors not more than 3 feet o.c.
 - b. Vertical conductors not more than 5 feet o.c.
 - 3. Install simultaneously with installation of conductors.
 - 4. MC Cable shall be supported by UL listed clip or clamp. Cable tie support is not acceptable.
- F. Miscellaneous Supports: Support miscellaneous electrical components separately and as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices.
- G. In overhead spaces, support metal boxes directly from the building structure via 1/4" minimum all-thread or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box. Supporting metal boxes utilizing ceiling type wire is not acceptable.
- H. Sleeves: Install in concrete slabs and walls and all other fire-rated floors and walls for cable installations as required. Where sleeves through floors are installed, extend above finish floor. For sleeves through fire rated-wall or floor construction, apply UL-listed fire stopping sealant in gaps between sleeves and cables in accordance with "Fire Resistant Joint Sealers" requirement of Division 7 Section "Joint Sealers." See Architectural plans for location and extent of fire rated assemblies.

- I. Conduit Seals: Install seals for conduit penetrations of exterior walls below grade. Tighten sleeve seal screws until sealing grommets have expanded to form watertight seal.
- J. Fastening: Unless otherwise indicated, fasten electrical items and their supporting hardware securely to the building structure, including but not limited to conduits, raceways, cables, cable trays, busways, cabinets, panelboards, transformers, boxes, disconnect switches, and control components in accordance with the following:
 - 1. Fasten by means of wood screws on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts or self-drilling masonry anchors on concrete or solid masonry, cast in inserts on precast structures, spring-tension clamps on steel. Drilling of structural steel members is prohibited. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts and machine or wood screws, where authorized by the Owner and structural engineer. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.
 - 2. Coordinate with the owner and structural engineer and obtain written prior approval of all work on concrete beams. Holes cut to depth of more than 1-1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete shall not cut the main reinforcing bars. Fill holes that are not used.
 - 3. Ensure that the load applied to any fastener does not exceed 25 percent of the proof test load. Use vibration- and shock-resistant fasteners for attachments to concrete slabs.
- K. Communication and Telephone Cable Supports: Use No. 9 ceiling wire to support individual or small bundles of cables run above accessible ceilings.

3.2 PERSONNEL PROTECTION:

- A. Where U-channel systems, angles, brackets or other standard structural metal shapes are readily accessible and exposed to personnel, provide plastic or rubber end caps.
- B. Where threaded rod supports are readily accessible and exposed to personnel, provide plastic or rubber end caps.

3.3 FIRE STOPPING LOCATIONS:

- A. Preparation:
 - 1. Coordination: Coordinate the work with other trades. Fire stopping materials at penetrations of insulated pipes and ducts can be applied after insulation is in place. If insulation is composed of combustible material, the thickness of fire stopping materials must be equivalent to that of the insulation. If the insulation is composed of non-combustible material, it may be considered as part of the penetrating item.
 - 2. Surface Preparation: Surface Preparation to be in contact with fire stopping materials shall be free of dirt, grease, oil, loose material or other substances that may affect proper fitting or the required fire resistance.
- B. Installation: Install fire stopping materials in accordance with the manufacturer's instructions.
- C. Cleaning: After completion of fire stopping work in any area, equipment shall be reviewed and walls, ceilings and all other surfaces shall be cleaned of deposits of firestop materials.

D. Inspection: The architect may select and the Owner will pay an independent testing laboratory to examine fire stopped areas to ensure proper installation prior to concealing or enclosing the fire stopped areas.

END OF SECTION 260529

SECTION 260533 - RACEWAY AND WIREWAY FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

- A. Extent of raceway work is indicated by drawings and schedules. Provide complete conduit systems for all conductors unless otherwise specified.
- B. Types of raceways specified in this section include the following:
 - 1. Electrical metallic tubing (EMT).
 - 2. Flexible metal conduit.
 - 3. Liquid-tight flexible metal conduit.
 - 4. Non-metallic Conduit and Ducts.
 - 5. Rigid metal conduit (RGC).
 - 6. Surface metal raceways.
 - 7. Wireways.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with electrical raceway work similar to that required for this project.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's technical product data, including specifications and installation instructions, for each type of raceway system required. Include data substantiating that materials comply with requirements.
- C. Shop Drawings: Submit dimensioned drawings of surface metal raceway systems showing layout of raceways and fittings, spatial relationships to associated equipment, and adjoining raceways, if any. Show connections to electrical power panels and feeders.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Subject to compliance with requirements, provide products by the following:
 - 1. Metallic Conduit:

- a. Atkore
- b. Wheatland
- c. Western Tube & Conduit
- d. Nucor Tubular
- 2. PVC Coated Conduit:
 - a. Atkore
 - b. Rob Roy
 - c. ABB
- 3. Non-Metallic Conduit:
 - a. Carlon
 - b. Can-Tex
- 4. Steel Fittings:
 - a. Hubbell
 - b. Emerson
 - c. Picoma
 - d. ABB
- 5. Conduit Bodies:
 - a. Hubbell
 - b. Appleton
 - c. Eaton
- 6. Surface Metal Raceways:
 - a. Legrand
 - b. Hubbell
 - c. Mono-Systems, Inc.
- 7. Wireway:
 - a. Schneider Electric Erickson Electric Equipment Co.
 - b. Hoffman Engineering Co.

2.2 METAL CONDUIT AND TUBING:

- A. Rigid Galvanized Steel Conduit (RGC):
 - 1. Conduit: Rigid steel, zinc-coated inside and outside, threaded ends.
 - 2. Fittings: Threaded galvanized steel, bushings shall have nylon insulated throat.
- B. PVC Externally Coated Rigid Steel Conduit:
 - 1. Conduit: Rigid steel zinc-coated with external coating of PVC.
 - 2. Fittings: Threaded galvanized steel with external PVC coating, bushings shall have nylon insulated throat.
- C. Electrical Metallic Tubing (EMT):

- 1. Conduit: Galvanized steel tubing.
- 2. Fittings: Steel compression fittings for rain-tight and concrete-tight applications. Steel set-screw for all other connections. Set-screw quick fit type for 2-1/2 inches and larger may be used. Bushings shall be threaded and have nylon insulated throat or nylon bushing.
- D. Flexible Metal Conduit:
 - 1. Conduit: Continuous spiral wound, interlocked, zinc-coated steel, approved for grounding.
 - 2. Fittings: Zinc coated, malleable iron. Straight connector shall be one-piece body, female end with clamp and deep slotted machine screw for securing conduit, and threaded male end provided with a locknut. Angle connectors shall be two piece body with removable upper section, female end with clamp and deep slotted machine screw for securing conduit, and threaded male end provided with a locknut. All fittings shall be terminated with threaded bushings having nylon insulated throats.
- E. Liquid-Tight Flexible Metal Conduit:
 - 1. Conduit: Continuous spiral wound, interlocked zinc-coated steel with polyvinyl chloride (PVC) jacket, approved for grounding.
 - 2. Fittings: Zinc coated malleable iron. Straight and angle connectors shall be the same as used with flexible metal conduit but shall be provided with a compression type steel ferrule and neoprene gasket sealing rings.

2.3 NON-METALLIC CONDUIT AND DUCTS:

- A. Rigid Non-Metallic Conduit (RNC):
 - 1. Conduit: Schedule 40 or 80 polyvinyl chloride (PVC), 90°C for direct burial or concrete encasement.
 - 2. Fittings: Mate and match conduit type and material. Cement as recommended by manufacturer.

2.4 CONDUIT BODIES:

- A. General: Types, shapes and sizes, as required to suit individual applications and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.
- B. Metallic Conduit and Tubing: Use malleable iron conduit bodies. Use bodies with threaded hubs for threaded raceways and in hazardous locations.
- C. Nonmetallic Conduit: Use nonmetallic conduit bodies.

2.5 WIREWAYS:

A. General: Provide electrical wireways of types, grades, sizes, and number of channels for each type of service as indicated. Provide complete assembly of raceway including, but not limited to, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other components and accessories as required for complete system.

- B. Lay-In Wireways: Construct lay-in wireways with hinged covers in accordance with UL 870 with components UL listed. Construct units to be capable of sealing cover in closed position with sealing wire.
 - 1. Connectors: Provide wireway connectors suitable for "lay-in" conductors, with connector covers permanently attached so that removal is not necessary to utilize the lay-in feature.
 - 2. Finish: Protect sheet metal parts with rust inhibiting coating and baked enamel finish. Plate finish hardware to prevent corrosion. Protect screws installed toward inside of wireway with spring nuts to prevent wire insulation damage.

2.6 SURFACE METAL RACEWAYS:

- A. General: Sizes and channels as indicated. Provide fittings that match and mate with raceway. All circuits either factory or field installed shall have a separate neutral conductor. Verify color with Architect/Engineer prior to order.
 - 1. Surface Metal Raceway: Galvanized steel with Snap-on cover. Finish in manufacturer's standard prime coating suitable for field painting. Provide raceways of suitable size based on fill for circuits indicated on the drawings. Provide all necessary boxes, covers, extensions, fittings, etc. to form a complete assembly. Provide the quantity of receptacles, devices, compartment channels, etc. as indicated on drawings.
- B. Boxes for Surface Raceways: Designed, manufactured and supplied by raceway manufacturer for use with specified raceway.

2.7 CONDUIT SIZES:

- A. Conduit sizes shall be as shown on the drawings. If the conduit size is not given on the drawings, the conduit shall be sized in accordance with NEC based on the number of conductors enclosed plus a parity sized equipment ground conductor and be subject to the following minimum sizes:
 - 1. Rigid, Intermediate, and EMT Conduit: 3/4 inch for all runs except lighting switch legs, 277 volt lighting branch circuits, temperature control and fire alarm which may be ½ inch.
 - 2. Flexible and Liquid-Tight Flexible Conduit: 1/2 inch for all runs.
 - 3. MC Cable: 3/8 inch to under-counter luminaires, 1/2inch for all other runs.
 - Conduits used for home runs shall contain only the conductors for the circuits indicated on the drawings. Combining multiple home runs into a single conduit will not be permitted.

2.8 RACEWAY SEALING COMPOUND:

A. Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 deg. F (1 deg. C), withstands temperature of 300 deg. F (149 deg. C) without slump, and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials and the common metals.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Examine areas and conditions under which raceways are to be installed, and substrate which will support raceways. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 CONDUIT SCHEDULE:

- A. Raceways in locations subject to mechanical injury: Rigid steel galvanized conduit or intermediate metal conduit.
- B. Motor and equipment connections: PVC jacketed liquid-tight flexible metallic conduit with liquid tight connectors.
- C. Raceways in all other areas shall be electrical metallic tubing unless otherwise noted.
- D. Use flexible metal conduit inside movable partition wireways, from junction boxes to devices and between devices in casework, from outlet boxes to recessed luminaires, and for "fishing" of existing walls.
- E. Rework or extensions of existing conduit shall include the use of similar materials to the existing conduit type unless otherwise noted.

3.3 INSTALLATION OF CONDUITS:

- A. General: Install electrical raceways in accordance with manufacturer's written installation instruction, applicable requirements of NEC, and as follows:
 - 1. Conceal all conduits unless indicated otherwise, within finished walls, ceilings, and floors. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot water pipes. Install raceways level and square and at proper elevations.
 - 2. Elevation of Raceway:
 - a. Where horizontal raceway is installed near water and steam piping, route raceway above piping and as close to structure as possible and practical.
 - b. Route raceway as close to structure as possible.
 - 3. Complete installation of electrical raceways before starting installation of conductors within raceways.
 - 4. Provide supports for raceways as specified elsewhere in Division 26.
 - 5. Prevent foreign matter from entering raceways by using temporary closure protection.
 - 6. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bend is not visible above the finished slab.
 - 7. Make bends and offsets so the inside diameter is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.
 - 8. Use raceway fittings that are types compatible with the associated raceway and suitable for the use and location. Install expansion fittings across all structural construction joints and expansion/deflection couplings across all structural expansion joints.

- 9. Run raceways parallel and perpendicular to building elements and other equipment with a minimum of bends in the shortest practical distance considering the type of building construction and obstructions except as otherwise indicated.
- 10. Install exposed raceways parallel and perpendicular to nearby surfaces or structural members and follow the surface contours as much as practical.
- 11. Install vertical feeder conduits in exterior walls, core walls, or chase spaces. Do not install in interior wall partition areas.
- 12. Run exposed and parallel raceways together. Make bends in parallel runs from the same center line so that the bends are parallel. Factory elbows may be used only where they can be installed parallel. In other cases provide field bends for parallel raceways.
- 13. Make raceway joints tight. Where joints cannot be made tight, use bonding jumpers to provide electrical continuity of the raceway system. Make raceway terminations tight. Where terminations are subject to vibration, use bonding bushings or wedges to assure electrical continuity. Where subject to vibration or dampness, use insulating bushings to protect conductors. Joints in non-metallic conduits shall be made with solvent cement in strict accordance with manufacturer's recommendations.
- 14. Tighten set screws of thread less fittings with suitable tool.
- 15. Terminations: Where raceways are terminated with locknuts and bushings, align the raceway to enter squarely and install the locknuts with dished part against the box. RGC and IMC shall be secured with double locknuts and an insulated metallic bushing. EMT shall be secured with one locknut and shall have nylon insulated throats or threaded nylon bushings from 1/2" to 1". 1-1/4" and above shall be metal with nylon insulated throats. Use grounding type bushings for feeder conduits at switchboards, panelboards, pull boxes, transformers, motor control centers, VFD's, etc.
- 16. Where terminating in threaded hubs, screw the raceway or fitting tight into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align the raceway so the coupling is square to the box, and tighten the chase nipple so no threads are exposed.
- 17. Provide nylon pull string with printed footage indicators having not less than 200 pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull string. Identify with tags at each end the origin and destination of each empty conduit and indicate same on all empty or spare conduits on the as-built drawings.
- 18. Telephone and Signal System Raceways: Install raceways with maximum lengths at 100 feet and with a maximum of two, 90 degrees radiused bends or equivalent. Install 2' x 2' pull boxes where necessary to comply with these requirements. Install long sweep bends for all data and voice raceways.
- 19. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings where required by the NEC.
- 20. Flexible Connections: Use short length (maximum of 6 feet) of flexible conduit for recessed and semi-recessed luminaires, for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquid-tight flexible conduit in wet locations. Install separate ground conductor across flexible connections. Where PVC conduit/couplings have been approved for exterior use and are exposed to sunlight, provide UV rated PVC coatings or protect with 2 coats of water based latex paint that is chemically compatible with the PVC products. Color selection shall be by Architect.
- 21. PVC externally coated rigid steel conduit: Patch all nicks and scrapes in PVC coating after installing conduit.
- 22. Where conduits are to be installed through structural framing members, the Contractor shall provide sleeves. The Architect/Engineer's written approval must be obtained prior to cutting, notching or drilling of structural framing members.
- 23. Ream the ends of all cut and/or threaded conduit. Ends shall be cut square.
- 24. Use of running threads for rigid or intermediate metallic conduit are not permitted. When threaded couplings cannot be used, provide 3 piece union or solid coupling.

- 25. Route conduit through roof openings for piping and ductwork where possible; otherwise, rout through jack with pitch pocket.
- 26. Conduits shall not cross pipe shafts or ventilation duct openings. Where conduits must penetrate air-tight spaces or plenums, seal around the conduit with a mastic acceptable to the Architect/Engineer.
- 27. Install an insulated ground conductor in all conduits.
- 28. Where individual conduits penetrate existing fire-rated walls and floors, pack void around conduit with fire rated insulation and seal opening around conduit with UL listed foamed silicone elastomer compound. Where conduits penetrate exterior walls, new floors, or roof, provide pipe sleeve one size larger than conduit, pack void around conduit with fire rated insulation, and seal opening around conduit with UL listed foam silicone elastomer compound.
- 29. Where conduit sleeves penetrate fire rated floors or walls for installation of system cables, MC cables, or modular wiring cables pack void around cables or empty sleeve with fire rated insulation and fill ends with fire-resistive compound. Seal opening around sleeve with UL listed foam silicone elastomer compound.
- 30. Use PVC-coated rigid steel or Fiberglass factory elbows for bends in plastic conduit runs longer than 100 feet, or in plastic conduit runs which have more than two bends regardless of length. Use long sweep bends for wiring larger than 350 mcm.
- 31. Wipe plastic conduit clean and dry before joining. Apply full even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.
- 32. Provide separate raceway systems for each of the following:
 - a. Lighting
 - b. Power Distribution
 - c. Communications and Data
 - d. Fire Alarm
 - e. Temperature Control
- 33. Paint new exposed conduits to match wall finish color. Coordinate exact requirements with the Architect.
- B. Install labeling as required in Division 26 section "Electrical Identification".

3.4 INSTALLATION OF SURFACE RACEWAYS AND WIREWAYS:

- A. Surface Raceways and Wireways: Mechanically assemble metal enclosures and raceways to form continuous electrical conductor and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
 - 1. Where practicable, avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion inhibiting compound before assembling.
 - 2. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
 - 3. Make changes in direction of raceway run with proper fittings, supplied by raceway manufacturer. Field bends of raceway sections are not permitted.
 - 4. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.
 - 5. Use boxes as supplied by raceway manufacturer wherever junction, pull or device boxes are required. Standard electrical "handy" boxes, etc., are not permitted for use with surface raceway installations.
 - 6. Install an insulated grounding conductor in all wireways and surface raceways. Bond grounding conductor to all wireways and surface raceways.
 - 7. Paint new exposed surface metal raceway to match adjacent surfaces where raceway is installed in finished areas such as lobbies, corridors, and normally occupied spaces.

- 8. Surface raceways and wireways are acceptable only where specifically indicated on the drawings. The proposed use of surface raceways and wireways shall be submitted for review by the Engineer prior to installation.
- 9. Common wireways are not acceptable for convergence of multiple circuits unless specifically indicated on the drawings. The proposed use of a common wireway shall be submitted for review by the Engineer prior to installation.
- 10. The proposed use of wireways above or below panelboards, switchboards, motor control centers, and other electrical equipment shall be submitted along with a layout drawing for review by the Engineer prior to installation.
- 3.5 ADJUSTING AND CLEANING:
 - A. Upon completion of installation of raceways, inspect interiors of raceways; clear all blockages and remove burrs, dirt and construction debris.

END OF SECTION 260533

SECTION 260534 - CABINETS, BOXES, AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY:

- A. This section includes cabinets, boxes, and fittings for electrical installations and certain types of electrical fittings not covered in other sections. Types of products specified in this section include:
 - 1. Outlet and device boxes
 - 2. Pull and junction boxes
 - 3. Cabinets
 - 4. Hinged door enclosures
- B. Conduit-body-type electrical enclosures and wiring fittings are specified in the Division 26 Section on Raceways.

1.2 DEFINITIONS:

- A. Cabinets: An enclosure designed either for surface or for flush mounting and having a frame, or trim in which a door or doors may be mounted.
- B. Device Box: An outlet box designed to house a receptacle device or a wiring box designed to house a switch.
- C. Enclosure: A box, case, cabinet, or housing for electrical wiring or components.
- D. Hinged Door Enclosure: An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box.
- E. Outlet Box: A wiring enclosure where current is taken from a wiring system to supply utilization equipment.
- F. Wiring Box: An enclosure designed to provide access to wiring systems or for the mounting of indicating devices or switches for controlling electrical circuits.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Submit product data for cabinets and enclosures with classification higher than NEMA 1.
- C. Shop drawings for boxes, enclosures, and cabinets that are to be shop fabricated (non-stock items). For shop fabricated junction and pull boxes, show accurately scaled views and spatial relationships to adjacent equipment. Show box types, dimensions, and finishes.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cabinets:
 - a. Hoffman Engineering Co.
 - b. Approved Equal
- 2.2 CABINETS, BOXES, AND FITTINGS, GENERAL:
 - A. Electrical Cabinets, Boxes, and Fittings: Of indicated types, sizes, and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for the use and location. Provide all items complete with covers including blank covers for unused boxes, knockout closures for unused openings and other accessories required for the intended use. Provide gaskets for units in damp or wet locations. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.
- 2.3 MATERIALS AND FINISHES:
 - A. Sheet Steel: Flat-rolled, code-gage, galvanized steel.
 - B. Fasteners for General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.
 - C. Fasteners for Damp or Wet Locations: Stainless steel screws and hardware.
 - D. Cast Metal for Boxes, Enclosures, and Covers; Copper-free aluminum except as otherwise specified.
 - E. Exterior Finish: Gray baked enamel for items exposed in finished locations except as otherwise indicated.
 - F. Painted Interior Finish: Where indicated, white baked enamel. Emergency system cabinets and boxes shall be red.
 - G. Fittings for Boxes, Cabinets, and Enclosures: Conform to UL 514B. Malleable iron or zinc plated steel for conduit hubs, bushings and box connecters.
- 2.4 METAL OUTLET, DEVICE, AND SMALL WIRING BOXES:
 - A. General: Conform to UL 514A, "Metallic Outlet Boxes, Electrical," and UL 514B, "Fittings for Conduit and Outlet Boxes." Boxes shall be of type, shape, size, and depth to suit each location and application. For multiple device installations, use multi-gang boxes. Sectional boxes are not permitted. Provide barrier for different voltage conductors in the same box.
 - B. Steel Boxes: Conform to NEMA OS 1, "Sheet Steel Outlet Boxes, Device Boxes, Covers, and Box Supports." Boxes shall be 4" square minimum with 2" depth minimum sheet steel with

stamped knockouts, threaded screw holes and accessories suitable for each location including mounting brackets and straps, cable clamps, exterior/plaster rings and fixture studs.

C. Malleable or Cast-Iron Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

2.5 PULL AND JUNCTION BOXES:

- A. General: Comply with UL 50, "Electrical Cabinets and Boxes", for boxes over 100 cubic inches volume. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.
- B. Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing.
- C. Hot-Dipped Galvanized Steel Boxes: Sheet steel with welded seams. Where necessary to provide a rigid assembly, construct with internal structural steel bracing. Hot-dip galvanized after fabrication. Cover shall be gasketed.
- D. Malleable or Cast-Iron Boxes: Molded of iron alloy with gasketed cover and integral threaded conduit entrances.

2.6 CABINETS:

- A. Comply with UL 50, "Electrical Cabinets and Boxes."
- B. Construction: Sheet steel, NEMA 1 class except as otherwise indicated. Cabinet shall consist of a box and a front consisting of a one piece frame and a hinged door. Arrange door to close against a rabbet placed all around the inside edge of the frame, with a uniformly close fit between door and frame. Provide concealed fasteners, not over 24 inches apart, to hold fronts to cabinet boxes and provide for adjustment. Provide flush or concealed door hinges not over 24 inches apart and not over 6 inches from top and bottom of door. For flush cabinets, make the front approximately ³/₄" larger than the box all around. For surface mounted cabinets make front same height and width as box.
- C. Doors: Double doors for cabinets wider than 24 inches.
- D. Telephone cabinets wider than 48 inches may have sliding or removable doors. Provide ³/₄" thick plywood backboard painted matte white for Television, telephone and other communication cabinets.
- E. Locks: Combination spring catch and key lock, with all locks for cabinets of the same system keyed alike. Locks may be omitted on signal, power, and lighting cabinets located within wire closets and mechanical-electrical rooms. Locks shall be of a type to permit doors to latch closed without locking.

2.7 STEEL ENCLOSURES WITH HINGED DOORS:

A. Comply with UL 50, "Cabinets and Enclosures" and NEMA ICS 6, "Enclosures for Industrial Controls and Systems."

- B. Construction: Sheet steel, 16 gage, minimum, with continuous welded seams. NEMA class as indicated; arranged for surface mounting.
- C. Doors: Hinged directly to cabinet and removable, with approximately ³/₄ inch flange around all edges, shaped to cover edge of box. Provide handle operated, key locking latch. Individual door width shall be no greater than 24 inches. Provide multiple doors where required.
- D. Mounting Panel: Provide painted removable internal mounting panel for component installation.
- E. Enclosure: NEMA 1 except as indicated. Where door gasketing is required, provide neoprene gasket attached with oil-resistant adhesive, and held in place with steel retaining strips. For all enclosures of class higher than NEMA 1, use hubbed raceway entrances.

2.8 CAST METAL ENCLOSURES WITH HINGED DOORS:

A. Copper free aluminum with bolted, hinged doors. Where used at hazardous (classified) locations, enclosures shall conform to UL and shall be listed and labeled for the classification of hazard involved.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL:

- A. Locations: Install items where indicated and where required to suit code requirements and installation conditions. Coordinate box locations with Architectural elements including casework, backsplash, door swings, etc.
- B. Cap with Knock out closures all unused knockout holes where blanks have been removed and plug unused conduit hubs.
- C. Support and fasten items securely in accordance with Division 26 Section on Supporting Devices.
- D. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated. Size boxes to accommodate wire pulling, splices, taps, equipment connections and code compliance.
- E. Remove sharp edges where they may come in contact with wiring or personnel.

3.2 APPLICATIONS:

- A. Cabinets: Flush mounted, NEMA enclosure type 1 except as otherwise indicated.
- B. Hinged Door Enclosures Indoor: NEMA type 1 enclosure except as indicated.
- C. Hinged Door Enclosures Outdoors: NEMA Type 4. Install drip hood, factory tailored to individual units.
- D. Hinged Door Enclosures in Corrosive Locations: NEMA type 4X nonmetallic enclosure.

- E. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types suitable for each location and in conformance with the following requirements:
 - 1. Interior Dry Locations: Sheet steel, NEMA Type 1.
 - 2. Locations Exposed to Weather or Dampness: Cast metal, NEMA type 3R.
 - 3. Wet Locations: NEMA Type 4 enclosures.
- F. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location except as otherwise indicated.

3.3 INSTALLATION OF OUTLET BOXES:

- A. Locations in Special Finish Materials: For outlet boxes for receptacles and switches mounted in desks or furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls, use rectangular shaped boxes with square corners and straight sides. Install such boxes without plaster rings. Saw cut all recesses for outlet boxes in exposed masonry walls.
- B. Gasketed Boxes: At the following locations use malleable or cast metal, threaded hub type boxes with gasketed weatherproof covers:
 - 1. Exterior locations.
 - 2. Where surface mounted on unfinished walls, columns or pilasters. (Cover gaskets may be omitted in dry locations).
 - 3. Where exposed to moisture laden atmosphere.
 - 4. High traffic areas (surface installations).
 - 5. Where indicated.
- C. Mounting: Mount outlet boxes for switches with the long axis vertical or as indicated. Mount boxes for receptacles vertically, except above counter receptacles to be mounted horizontally. Three or more gang boxes shall be mounted with the long axis horizontal. Locate box covers or device plates so they will not span different types of building finishes either vertically or horizontally. Locate boxes for switches near doors on the side opposite the hinges and close to door trim, even though electrical floor plans may show them on hinge side. Provide far side box supports, for electrical switch boxes installed on metal studs and provide stud to stud support for electrical receptacle boxes installed on metal studs.
- D. Ceiling Outlets: For fixtures, where wiring is concealed, use outlet boxes 4 inches square by 1-1/2 inches deep, minimum.
- E. Cover Plates for Surface Boxes: Use plates sized to box front without overlap.
- F. Protect outlet boxes to prevent entrance of plaster, and debris. Thoroughly clean foreign material from boxes before conductors are installed.
- G. Concrete Boxes: Use extra deep boxes to permit side conduit entrance without interfering with reinforcing, but do not use such boxes with over 6 inch depth.
- H. Existing Outlet Boxes: Where extension rings are required to be installed, drill new mounting holes in the rings to align with the mounting holes on the existing boxes where existing holes are not aligned.
- I. Back to back outlet boxes are not permitted. Separate boxes a minimum of 6 inches in standard walls and 24 inches in acoustical walls.

3.4 INSTALLATION OF PULL AND JUNCTION BOXES:

A. Box Selection: For boxes in main feeder conduit runs, use sizes not smaller than 8 inches square by 4 inches deep. Do not exceed 6 entering and 6 leaving raceways in a single box. Quantities of conductors (including equipment grounding conductors) in pull or junction box shall not exceed the following:

Size of	Maximum no. of
Largest Conductors	Conductors in
<u>in Box</u>	<u>Box</u>
No. 4/0 AWG	30
250 MCM	20
500 MCM	15
Over 500 MCM	10

- B. Cable Supports: Install clamps, grids, or devices to which cables may be secured. Arrange cables so they may be readily identified. Support cable at least every 30 inches inside boxes.
- C. Mount pull boxes in inaccessible ceilings with the covers flush with the finished ceiling. Where possible, locate pull and junction boxes above accessible ceilings in finished areas.
- D. Flush in grade outdoor boxes shall be adequately supported against settling or tipping. Where heavy traffic or poor soil compaction exists, cast box in concrete base which provides 6" of cover around and under the box.
- E. Size: Provide pull and junction boxes for telephone, signal, and other systems at least 50 percent larger than would be required by Article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems.

3.5 INSTALLATION OF CABINETS AND HINGED DOOR ENCLOSURES:

- A. Mount with fronts straight and plumb.
- B. Install with tops 78 inches above floor.
- C. Set cabinets in finished spaces flush with walls.

3.6 GROUNDING:

A. Electrically ground metallic cabinets, boxes, and enclosures. Where wiring to item includes a grounding conductor, provide a grounding terminal in the interior of the cabinet, box or enclosure.

3.7 CLEANING AND FINISH REPAIR:

- A. Upon completion of installation, inspect components. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, abrasions and weld marks.
- B. Galvanized Finish: Repair damage using a zinc-rich paint recommended by the tray manufacturer.

C. Painted Finish: Repair damage using matching corrosion inhibiting touch-up coating.

END OF SECTION 260534

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY:

- A. This Section includes identification of electrical materials, equipment, and installations. It includes requirements for electrical identification components including but not limited to the following:
 - 1. Identification labeling for raceways, cables, and conductors.
 - 2. Operational instruction signs.
 - 3. Warning and caution signs.
 - 4. Equipment labels and signs.
- B. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 23.

1.2 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data for each type of product specified.
- C. Submit schedule of identification nomenclature to be used for identification signs and labels for each piece of equipment including, but not be limited to, the following equipment types as specified in Division 26.
 - 1. Cabinets and enclosures
 - 2. Panelboards
 - 3. Disconnect switches
 - 4. Circuit breakers and switches
 - 5. Starters
 - 6. Variable frequency drives
 - 7. Fire alarm system panels and all ancillary cabinets and equipment
 - 8. Lighting control
- D. Submit samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.

1.3 QUALITY ASSURANCE:

A. ANSI Compliance: Comply with requirements of ANSI Standard A13.1, "Scheme for the Identification of Piping Systems," with regard to type and size of lettering for raceway and cable labels.

PART 2 - PRODUCTS

- 2.1 MANUFACTURERS:
 - A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Ideal Industries, Inc.
 - 2. LEM Products, Inc.
 - 3. Markal Corp.
 - 4. Panduit Corp.
 - 5. W.H.Brady, Co.
 - 6. 3M Company

2.2 ELECTRICAL IDENTIFICATION PRODUCTS:

- A. Adhesive Marking Labels for Exposed Raceway and Busway: Pre-printed, flexible, self-adhesive labels with legend indicating voltage and service (Lighting, Power, HVAC, Communications, Control, Fire).
 - 1. Label Size for Raceways and Busway: Kroy or Brother Labels 1 inch high by 12 inches long (minimum) with 5/8 inch minimum height letters.
 - 2. Normal:
 - a. 208V & 120V: Black letters on white background indicating source equipment designation, circuit number(s), and voltage.
 - b. 277V: Black letters on orange background indicating source equipment designation, circuit number(s), and voltage.
 - c. 480V: Black letters on yellow background indicating source equipment designation, circuit number(s), and voltage
 - 3. Fire Alarm: White letters on red background indicating "FIRE ALARM".
 - 4. Temperature Control: Black letters on blue background indicating "TEMP. CONTROL."
 - 5. Ground: White or black letters on green background indicating "GROUND" and equipment and designation.
 - 6. Building Alarms: Orange letters on white background indicating "BUILDING ALARMS."
 - 7. Network Fiber: Black letters on white background indicating "NETWORK FIBER."
 - 8. Where conduits enter or exit a panelboard, pull or junction box, switchboard, or other distribution equipment, conduit labels shall include circuit number in addition to feeder identification and voltage.
- B. Provide colored Adhesive Marking Tape for banding Wires and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width. Make each color band completely encircling cables, at penetrations of walls and floors, at each junction box and at 20-foot maximum intervals in straight runs.
- C. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.
- D. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16 inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Engraved legend in white letters on black face for normal and white letters on red face for emergency, black letters on yellow face for UPS and punched for

mechanical fasteners. Where required for ground connections, provide engraved legend in white letters on green face.

- E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless steel screws when screw ends do not protrude into working areas of equipment otherwise use number 10/32 stainless steel machine screws with nuts and flat and lock washers or rivets.
- F. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50 lb minimum tensile strength, and suitable for a temperature range from minus 50 degrees F to 350 degrees F. Provide ties in specified colors when used for color coding.
- G. Adhesive Marking Tape for Device Cover Plates: 3/8 inch Kroy tape or Brother labels with 3/16 inch minimum height letters. Tape shall have black letters on clear background for normal and red letters on clear background for emergency. Embossed Dymo-Tape labels are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code. Clean surfaces to receive nameplates and labels and install nameplates and labels on front of equipment parallel with equipment/raceway/cable/wire/etc. lines.
- B. Install identification devices in accordance with manufacturer's written instructions and requirements of NEC.
- C. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- D. Conduit Identification:
 - Adhesive Marking Labels: Provide adhesive marking labels for exposed raceway and busway and Raceway or Busway located above accessible ceilings. Install labels at //30 foot intervals. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible. Labels for multiple conduits shall be aligned and read the same direction. Marking labels shall be located on conduits entering or leaving every junction box.
- E. Identify Junction, Pull and Connection Boxes: Identification of systems and circuits shall indicate system voltage and identity of contained circuits on outside of box cover. Color code shall be same as raceway systems. Use self-adhesive marking tape labels at exposed locations and indelible black marker at concealed boxes.
- F. Circuit Identification: Tag or label conductors as follows:
 - 1. Future Connections: Conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers.
 - 2. Multiple Circuits: Where multiple branch circuits, control wiring or communications/signal conductors are terminated or spliced in a box or enclosure, label each conductor or cable

with circuit number. For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes.

- G. Apply circuit/control/item designation labels of engraved plastic laminate for disconnect switches, breakers, pushbuttons, pilot lights, and similar items for power distribution and control components above, except panelboards and alarm/signal components, where labeling is specified elsewhere.
- H. For panelboards, provide framed, typed circuit schedules (label all spares and spaces in pencil) with explicit description and identification of items controlled by each individual breaker.
- I. Install labels at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
- J. Provide adhesive marking tape labels for identification of individual receptacles including receptacles in furniture systems and light switch wall-plates. Locate tape on front of plate and identify panel and branch circuit serving the receptacle. Provide tape labels for identification of individual switches or thermal overload switches which serve as equipment disconnects. Locate the tape on the front of the cover-plate and identify panel and branch circuit serving the equipment.

END OF SECTION 260553

SECTION 260583 - WIRING CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY:

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Applications of electrical power connections specified in this section include the following:
 - 1. To resistive heaters.
 - 2. From electrical source to motor starters.
 - 3. From motor starters/motor controllers/VFD's/etc. to motors.
 - 4. To lighting equipment.
 - 5. To grounds including earthing connections.
 - 6. To master units of communication, signal, alarm, and video systems.
 - 7. From push buttons to equipment requiring electrical connection.
 - 8. Other connections as shown.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 2 years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's data on electrical connections for equipment products and materials. All mechanical and plumbing equipment shall be coordinated with unit nameplate information per the actual nameplate to be included on the equipment. As a minimum, information shall include: Operating Voltage; MCA (Min. circuit amperes); FLA (Full load amperes); MFS (Max. fuse size) or MOP (Max. overcurrent protection); and SCCR (Short Circuit Current Rating) and shall match electrical equipment and protection/distribution sizes and be rated for available short circuit currents as shown on the drawings. Bracing for equipment shall be provided at incoming terminals and as an option throughout the equipment for the available fault current or downstream equipment and devices shall be protected by current limiting fuses.

1.4 DEFINITIONS:

- A. Load voltage wiring shall be defined as:
 - 1. Conduit and wiring required to carry power to motors and other equipment or devices. Wiring from control devices to equipment that carry power to drive that equipment such as line voltage thermostats, etc., shall be included as load voltage wiring. Wiring that provides power to control panels, control transformers, control relays, time clocks, etc., shall also be included as load voltage wiring.
- 1.5 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver electrical connection products wrapped in proper factory fabricated type containers.
 - B. Store electrical connection products in original cartons and protect from weather, construction traffic and debris.
 - C. Handle electrical connection products carefully to prevent breakage, denting, and scoring finish.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturer: Subject to compliance with requirements, provide circuit and motor disconnects by one of the following:
 - 1. GE/ABB
 - 2. Siemens
 - 3. Eaton
 - 4. Square D

2.2 GENERAL:

- A. Overcurrent Protective Devices (OCPDs): Provide type, rating, and features as indicated. Comply with Division 26 Section on Low Voltage Circuit Protective Devices, with OCPDs adapted to equipment connection installation. Tandem circuit breakers shall not be used. Multiple breakers shall have common trip.
- B. Provide motor controllers that are horsepower rated to suit the motor controlled.
- C. Contacts shall open each ungrounded connection to the motor. Contacts shall be NEMA rated, 75 degrees C.
- D. Overload relays shall be ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full load current of the specific motor to which connected with appropriate adjustment for duty cycle and power factor correction supplied with the motor.
2.3 MATERIALS AND COMPONENTS:

- A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkable insulating tubing, cable ties, solderless wire-nuts, disconnect, starter, contactor, relays, etc., and other items and accessories as needed to complete splices and terminations of types indicated.
- B. Metal Conduit, Tubing and Fittings:
 - 1. General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Provide products complying with Division-26 section on Raceways.
- C. Wires, Cables, and Connectors:
 - 1. General: Provide wires, cables, and connectors complying with Division-26 section on Wires and Cables.
 - 2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match, including sizes, ratings, and material of wires/cables which are supplying electrical power.
 - 3. Connectors and Terminals: Provide electrical connectors and terminals which mate and match, including sizes and ratings, with equipment terminals and are recommended by equipment manufacturer for intended applications.
 - 4. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, electrical solder, electrical soldering flux, wire-nuts and cable ties as recommended for use by accessories manufacturers for type services indicated.
 - 5. Cord and Plug Connected Equipment: Where indicated, contractors shall provide a length of SO cord complete with a straight blade or twist-lock receptacle for connection of equipment. Cord and plug rating shall be suitable for the connected equipment load and rating of the branch circuit overcurrent protective device. Plug shall match receptacle configuration included on the plans and cord length shall be as required. Contractor shall connect cord to equipment.

2.4 MANUAL MOTOR STARTERS:

- A. Manual starters shall be flush-mounting type except where conduits are run exposed or as otherwise noted. Manual starters shall be complete with properly sized overload protection and neon pilot light. Manual starters shall be Square D Class 2510 or Allen-Bradley Bulletin 600 with stainless steel plates. Handles shall be lockable in open and closed position without modification.
- B. Heater units in all manual motor starters shall be sized for approximately 115 percent of full load motor current. Check and coordinate all thermal protective devices with the equipment they protect.

2.5 CIRCUIT AND MOTOR DISCONNECT SWITCHES:

A. General: Provide circuit and motor disconnect switches in types, sizes, duties, features, ratings, and enclosures as indicated. All equipment with maximum fuse size listed in nameplate shall have fusible disconnect switch provided. Provide NEMA 1 enclosure. For outdoor switches and switches indicated as weatherproof, provide NEMA 3R enclosures with rain-tight hubs. For

motor and motor starter disconnects, provide units with horsepower ratings suitable to the loads.

- B. Fusible Switches: Provide UL type "HD" 100 percent duty rated switches, with fuses of classes and current ratings indicated. Where current limiting fuses are indicated, provide switches with non-interchangeable feature suitable only for current limiting type fuses. All disconnect switches shall be fusible unless otherwise noted.
- C. Non-fusible Disconnects: Provide UL type "HD" 100 percent duty rated switches of classes and current ratings as indicated.
- D. Accessories:
 - 1. Electrical Interlocks: Provide number and arrangement of interlock contacts in switches as indicated or required.
 - 2. Special Enclosure Material: Provide special enclosure material as follows for switches indicated:
 - a. Stainless Steel Type 304: For NEMA Type 4.
 - b. Molded Fiberglass Reinforced Plastic: For NEMA Type 4x.
 - 3. Handles shall be lockable in open and closed position without modification.
 - 4. Disconnect switches provided in the motor feeders between a VFD and the motor shall be provided with auxiliary contacts at the disconnect that de-energizes power to the VFD.

2.6 MOTOR STARTERS:

A. See Division 23 for Requirements

2.7 AUXILIARY CONTROL DEVICES:

- 1. Built in 120 volts control circuit transformer, fused from line side, where service exceeds 120 volts.
- 2. Ammeters, Voltmeters, and Frequency Meters: Panel type, 2-1/2 inch minimum size with 90 degree or 120 degree scale and plus or minus 2 percent accuracy. Where indicated. Current Sensors: Rated to suit application.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect area and conditions under which electrical connections for equipment are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.2 INSTALLATION OF ELECTRICAL CONNECTIONS:

A. Furnish, set in place, and wire (except as may be otherwise indicated) all heating, ventilating, air conditioning, plumbing and fire protection, elevator, etc., motors and controls in accordance with

the following schedule and in accordance with equipment manufacturer's written instructions and with recognized industry practices, and complying with applicable requirements of UL, NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements. Carefully coordinate with work performed under the Mechanical Division of these Specifications.

- B. Coordinate with other work, including wires/cables, raceway and equipment installation, as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. Maintain existing electrical service and feeders to equipment serving occupied areas and operational facilities, unless otherwise indicated, or when authorized otherwise in writing by Owner, or Architect/Engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.
- F. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.
- H. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturers published torque tightening values for equipment connectors. Accomplish tightening by utilizing proper torqueing tools, including torque screwdriver, beam-type torque wrench, and ratchet wrench with adjustable torque settings. Where manufacturer's torqueing requirements are not available, tighten connectors and terminals to comply with torqueing values contained in UL's 486A.
- I. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- J. Provide suitable strain relief clamps for cord connection to outlet boxes and equipment connection boxes.
- K. Make wiring connections in control panel or in wiring compartment of pre-wired equipment and interconnecting wiring in accordance with manufacturer's instructions.
- L. Install disconnect switches, controllers, control stations, and control devices such as limit switches and temperature switches as indicated or per manufacturer's instructions.
- M. Provide each motor with a fused disconnect switch for 3 phase motors and horsepower rated and/or thermal rated disconnect switch for single phase motors as shown on schedules or required. Coordinate with manufacturers of standalone, packaged and other equipment for factory installed and field installed motors and controllers.

- N. Provide circuit and motor disconnect switches as indicated and where required by Code. Comply with switch manufacturers printed installation instructions. Install within sight of motors.
- O. All splices in control panels, terminal junction boxes, low voltage control circuits and fire alarm conductors shall be on numbered terminal strip.
- P. Each branch circuit serving dedicated, isolated or emergency receptacles, multi-outlet assemblies or equipment connections shall be furnished with a dedicated neutral conductor. Neutrals common to more than one circuit shall only be permitted where specifically noted.
- Q. Where conduit is not required, plenum rated cable shall be provided in ceiling, floor or other air plenum spaces.

3.3 FIELD QUALITY CONTROL:

A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

3.4 EQUIPMENT CONNECTION SCHEDULES:

- A. Mechanical Equipment:
 - 1. Refer to Mechanical Equipment Schedule on the drawings.
 - 2. It is suggested that all load voltage wiring shall be provided under Division 26.
 - 3. Unless otherwise indicated, it is suggested that all equipment motors and control shall be furnished, set in place, and wired in accordance with the schedule contained herein. The exact furnishing and installation of the equipment is left to the Contractors involved. Contractor should note that the intent of this schedule is to have the Contractor responsible for coordinating all wiring as outlined, whether or not specifically called for by the Division 23 or Division 26 drawings and specifications. Comply with the applicable requirements of Division 26 for all electrical work which is not otherwise specified. No extras will be allowed for contractor's failure to provide for these required items. Contractor shall refer to the Division 26 and Division 23 specifications and plans for all power and control wiring and shall advise the Architect/Engineer of any discrepancies prior to bidding.

ITEM	FURNISHED BY	SET BY	CONTROL WIRING (non-load voltage)
1. Mechanical Equipment Motors	М	М	
 2. Special Equipment (i.e., elevators, etc.) a. Motors b. Magnetic Motor Starters c. Disconnect Switches d. Thermal OL Switches e. Manual Operating Switches 	G G E	G E* E	

ITEM	FURNISHED BY	SET BY	CONTROL WIRING (non-load voltage)
 Motor Starters, combination motor starter/disconnect and Variable Frequency Drives Automatically controlled, with or without HOA switches. 	М	E*	М
b. Manually controlled.	М	E*	
 c. Starters integral with motor control center including control relays and transformers 	E	E	
d. Combination Starter/Disconnects	М	E*	М
4. Pushbutton stations, pilot lights	М	E*	М
5. Disconnect switches, thermal overload switches, manual operating switches.	E	E*	М
6. Multi-speed switches	М	E*	М
7. Control relays, transformers.	М	М	М
 Load voltage control items such as line voltage thermostats not connected to control panel systems. 	М	М	E
9. Non-load voltage control items.	М	М	М
 Electric thermostats, remote bulb thermostats, motor valves, float controls, etc., which are an integral part of mechanical equipment or directly attached to ducts, pipes, etc. 	М	М	М
11. Motor valves, damper motor, solenoid valves, EP and PE switches, VAV box controls, actuators, etc.	М	М	M**
12. Control circuit outlets	E	E	
 Load voltage control items such as line voltage thermostats not connected to control panel systems. 	M	М	E
b. Non-load voltage control items.	М	М	М
 c. Electric thermostats, remote bulb thermostats, motor valves, float controls, etc., which are an integral part of mechanical equipment or directly attached to ducts, pipes, etc. 	М	М	М
d. Motor valves, damper motor, solenoid valves, EP and PE switches, VAV box controls, actuators, etc.	М	М	M**
e. Control circuit outlets	E	E	
13. Load voltage control items such as line voltage thermostats not connected to control panel systems.	М	М	E
14. Non-load voltage control items.	М	М	М
 Electric thermostats, remote bulb thermostats, motor valves, float controls, etc., which are an integral part of mechanical equipment or directly attached to ducts, pipes, etc. 	М	М	М

ITEM	FURNISHED BY	SET BY	CONTROL WIRING (non-load voltage)
16. Motor valves, damper motor, solenoid valves, EP and PE switches, VAV box controls, actuators, etc.	М	М	M**
17. Control circuit outlets	E	E	
 Load voltage control items such as line voltage thermostats not connected to control panel systems. 	М	М	E
19. Non-load voltage control items.	М	М	М
20. Fire protection controls (Including flow switches)	М	М	M**
21. Duct smoke detectors, including relays for fan shutdown.	E	М	M**
22. Temperature Control Panel	М	М	М
23. Interlocks	М	М	М

G = General, Division 13 or 14

M = Mechanical, Division 23

E = Electrical, Division 26

* For factory pre-wired equipment specified under other Divisions, all wiring within the equipment shall be by the manufacturer. All required field wiring between sections or other field connection details for power and/or control shall be clearly identified on shop drawings for contractor installation. Division 26 drawings show the provided electrical characteristics for equipment.

Manufacturer's equipment provided under other divisions which varies from what is shown on Division 26 drawings shall be the responsibility of the Contractor to complete and pay for any costs for those variations.

- ** Fire alarm system control modules and wiring from fire alarm contacts to fire alarm system shall be installed by Fire Alarm system installer and match other components of the system. Refer to Division 28. See details.
- *** Integral control wiring under Electrical Division as manufacturer supplied equipment. Control wiring for automatic control portion under Mechanical Division.

END OF SECTION 260583

SECTION 260923 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY:

- A. Extent of lighting control equipment work is indicated by drawings and schedules, and is hereby defined to include, but not by way of limitation, programmable controllers, data equipment, relays, switches, control wiring, and ancillary equipment.
- B. Types of lighting control equipment specified in this section include the following:
 - 1. Digital Programmable Lighting Controls
 - 2. Occupancy Sensors
 - 3. Photoelectric Relays
- C. Refer to other Division-26 sections for wires/cables, electrical boxes and fittings and wiring devices which are required in conjunction with lighting control equipment work.

1.2 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Shop Drawings: Submit layout drawings of lighting control equipment and components including, but not necessarily limited to, programmable controllers, manual override switches and stations, occupancy/vacancy sensors, dimmers, dimmer system components, daylight sensors, transceivers, printers, relays and other switches and equipment. Drawings shall show locations and associated addresses of all devices and equipment. In addition, show spatial relationship of lighting control equipment to other electrical equipment in proximity. List and verify that design sequence of operation and programmability including initial sensor/programed on/off times, override control settings, etc., have been provided for each lighting control zone.
- C. Submit lists of Ballast/Driver and Lamp combinations compatible with dimmer systems, by manufacturer and catalog number.
- D. Wiring Diagrams: Submit wiring diagrams for lighting control equipment and components showing control and interconnection wiring, include connections to equipment components and electrical power feeders. Differentiate between portions of wiring that are manufacturer-installed and portions that are field-installed. Provide a voltage drop calculation for network cabling to verify EOL voltage compliance.
- E. Coordination Drawings: Submit evidence that lighting controls and devices are compatible with connected monitoring and control devices. Show interconnecting signal and control wiring and interfacing devices that prove compatibility of inputs and outputs. For networked controls, list network protocols and provide statements from manufacturers that input and output devices meet interoperability requirements of the network protocol.
- F. Agreement to Maintain: Prior to time of final acceptance, the Installer shall submit an agreement for continued service and maintenance of lighting control equipment, for Owner's possible acceptance. Offer terms and conditions for furnishing parts and providing continued

testing and servicing, including replacement of materials and equipment, for one year period with option for renewal of Agreement by Owner.

- G. Maintenance Manuals: Ensure manual includes operating instructions in addition to instructions for maintenance of the system's software package.
- H. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.
- I. Commissioning Report: Submit Preliminary and Final Commissioning Report for all Lighting Control Equipment. Preliminary report shall be submitted no later than 90 days of the date of receipt of the certificate of occupancy. Reports shall be organized and include information as required by the current edition of the IECC-International Energy Conservation Code.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting control equipment and ancillary equipment, of types, ratings and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with lighting control equipment work similar to that required for this project.
- C. Agreement to Maintain: Engage Installer who is willing to execute with the Owner, required agreement for continued maintenance of lighting control equipment.
- D. FCC Compliance: Comply with Part 68 of Federal Communications Commission Rules pertaining to telephone equipment registration by manufacturer.
 - 1. Provide telephone equipment with FCC labels indicating applicable FCC registration and numbering of equipment.
- E. Codes and Standards:
 - 1. Energy Code Compliance: Meet the requirements of the current edition of the IECC-International Energy Conservation Code. In addition, meet any additional requirements of the Local AHJ-Authority Having Jurisdiction.
 - Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to construction, installation of lighting control and communications equipment.
 - 3. Control wiring shall be in accordance with the NEC requirements for Class 2 remote control systems, Article 725 and manufacturer specification.
 - 4. UL Compliance: Comply with applicable requirements of UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide lighting control equipment and components which are UL-listed and labeled. Lighting control panels shall be UL 916 and UL 924 Listed.
 - 5. NEMA Compliance: Comply with applicable requirements of NEMA's Std. Pub No. 250, "Enclosures for Electrical Equipment (1000-Volts Maximum)."
 - 6. EIA Compliance: Comply with applicable requirements of Electronic Industries Association standards pertaining to telephone and electronic systems.

1.4 DELIVERY, STORAGE AND HANDLING:

- A. Deliver lighting control equipment and components in factory-fabricated type containers or wrappings, which properly protect equipment from damage.
- B. Store lighting control equipment in original packaging and protect from weather and construction traffic. Wherever possible, store indoors; where necessary to store outdoors, store above grade and enclose with watertight wrapping.
- C. Handle lighting control equipment carefully to prevent physical damage to equipment and components. Do not install damaged equipment; remove from site and replace damaged equipment with new.

1.5 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Electrically Held Relays: Equal to 5% of amount installed.
 - 2. Occupancy/Vacancy Sensors: Equal to 5% of the amount installed for each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide lighting control equipment of one of the following (for each type and rating of equipment):
 - 1. Digital programmable lighting controls:
 - a. Acuity nLight (Campus Standard)

2.2 DIGITAL PROGRAMMABLE LIGHTING CONTROLS:

- A. General: Provide factory-fabricated lighting control equipment and ancillary components of sizes, types, ratings and electrical characteristics indicated; consisting of programmable controllers, data equipment, relays, switches, control wiring, interfaces to dimming systems, and interfaces to building management systems which comply with manufacturer's standard design, materials and components; and construct in accordance with published product information for duty indicated, and as required for a complete installation.
- B. Expandability: System shall be capable of increasing the number of control functions in the future by 25 percent of current capacity; to include equipment ratings, housing capacities, spare relays, terminals, number of conductors in control cables, and control software.
- C. Performance Requirements: Manual switches, an internal timing and control unit, and external sensors or other control signal sources send a signal to a programmable-system control module that processes the signal according to its programming and routes an open or close command to one or more relays in the power-supply circuits, or routes variable commands to one or more dimmers, for groups of lighting fixtures or other loads.

- D. Programmable Lighting Controller Description: Programmable, unit with graphic display and programming of system status and to override relay status; and to display status of local override controls and diagnostic information.
 - 1. Interoperability:
 - a. Controller shall be configured to connect to a BACnet-compliant network, resulting in extending control to any network-compliant devices such as occupancy/vacancy switches.
 - b. Mechanical Controls Interface: Where indicated, occupancy sensors within a control zone shall send occupied state or unoccupied state information to BAS, associated Network, or individual room equipment as identified by Mechanical Controls Contractor.
 - 1) Provide all necessary interface components to allow the lighting control system and BAS/Network/Equipment to seamlessly communicate.
 - 2. System Memory: Nonvolatile. System shall reboot program and reset time automatically without errors after power outages up to 90 days' duration.
 - 3. Software: Lighting control software shall be capable of linking switch inputs to relay outputs, retrieving links, viewing relay output status, controlling relay outputs, simulating switch inputs, setting device addresses, and assigning switch input and relay output modes.
 - 4. Automatic Time Adjustment: System shall synchronize to real time through internet protocol, shall automatically adjust for leap year with manual time and date of adjustment selection, shall automatically adjust for daylight saving time with manual ON/OFF for this feature, and shall provide Time Controls utilizing 7 Day clock with minimum 7 different day times per week, and programmable auto Holiday "shutoff".
 - 5. Astronomic Control: Automatic adjustment of dawn and dusk switching based on exterior photoelectric sensor control.
 - 6. Automatic battery backup shall provide power to maintain program and system clock operation for 3 days' minimum duration when power is off.
 - 7. Flick Warning: Programmable momentary turnoff of lights shall warn that programmed shutoff will occur after a preset interval. Warning shall be repeated after a second preset interval before end of programmed override period.
 - 8. Diagnostics: When system operates improperly, software shall initiate factoryprogrammed diagnosis of failure and display messages identifying problem and possible causes.
 - 9. Automatic Control: System capable of activating building areas into user dictated pattern of ON-OFF array of relays, according to either weekly schedule divided into one-minute increments, or two one-day schedules.
 - 10. Automatic Control of Local Override: Automatic control shall switch lighting off if lighting has been switched on by local override. Utilize "Flick Warning" where indicated.
 - 11. Manual Controls: System capable of activating each lighting zone or single groups of relays ON-OFF with a momentary switch; Provide prioritization of manual controls.
 - 12. Manual Lockout: System capable of selecting, activating and locking-in any lighting pattern from central controller, and locking-out manual and automatic commands.
- E. Manual Switches and Plates
 - 1. Switches: Provide momentary toggle type ON-OFF switches with spring return to center position; and as recommended by lighting systems manufacturer for services indicated. An integral pilot light shall indicate the status of circuit.
 - 2. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

F. Relays: Provide relays for control of inductive loads of 20 amperes at 120-volts, 50 to 60 Hz, as recommended by lighting systems manufacturer for services indicated.

2.3 OCCUPANCY/VACANCY SENSORS:

- A. Wall or ceiling-mounting, solid-state units with a separate relay unit.
 - 1. Provide Dual Technology Devices unless otherwise shown. Spacing and coverage per the manufacturer's recommendations.
 - 2. Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 30 minutes.
 - 3. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 4. Relay Unit: Dry contacts rated for 20-Å ballast/driver load at 120- and 277-V ac.
 - 5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - 6. Bypass Switch: Override the on function in case of sensor failure.

2.4 PHOTOELECTRIC SENSORS:

- A. Ceiling-Mounted Photoelectric Switch: Solid-state, light-level sensor unit, with separate relay unit, to detect changes in lighting levels that are perceived by the eye. Cadmium sulfide photoresistors are not acceptable.
 - 1. Sensor Output: Contacts rated to operate the associated relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - 2. Light-Level Monitoring Range: 10 to 1000 fc with an adjustment for turn-on and turn-off levels within that range.
 - 3. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling, with dead-band adjustment.
- B. Outdoor Photoelectric Switch: Solid-state, light-level sensor unit to detect changes in lighting levels that are perceived by the eye.
 - 1. Light-Level Monitoring Range: 1.5 to 10 fc with an adjustment for turn-on and turn-off levels within that range.
 - 2. Time Delay: 30 second minimum to prevent cycling, with dead-band adjustment.
 - 3. Surge Protection: Metal-oxide varistor, complying with IEEE requirements for Category A1 locations.
 - 4. Mounting: Twist lock complying with IEEE C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which lighting control equipment is to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not

proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.2 INSTALLATION OF LIGHTING CONTROL EQUIPMENT:

- A. Install lighting control system components and ancillary equipment as indicated, in accordance with equipment manufacturer's written instructions, and with recognized industry practices, to ensure that lighting control equipment complies with requirements. Comply with requirements of NEC, and applicable portions of NECA's "Standard of Installation" pertaining to general electrical installation practices.
- B. Low voltage control wiring terminations shall be made within electrical boxes.
- C. Coordinate with other electrical work, including raceways, and electrical boxes and fittings, as necessary to interface installation of lighting control equipment work with other work.
- D. Interconnect lighting control equipment with building management system, after lighting equipment installation work has been completed and is operating properly. Define groups in the lighting control system to interface with the building management system as indicated on the temperature control matrix.
- E. Tighten electrical connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Std. 486A and B.
- F. Co-locate equipment as much as practical for ease of maintenance.
- G. Provide hardwired connections to each device, controller, sensor, etc. for control connections.

3.3 GROUNDING:

A. Provide equipment grounding connections for lighting control equipment as indicated. Tighten connectors to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounding.

3.4 FIELD QUALITY CONTROL:

- A. Upon completion of installation and after circuitry has been energized, demonstrate capability and compliance of system with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting. Testing and retesting at no cost to Owner.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust all field-assembled components and equipment installation, including connections, and assist in field testing. Report results in writing with commissioning report.
- C. Perform the following field tests and inspections for each piece of equipment and each device and prepare test reports:
 - 1. Test for circuit continuity.
 - 2. Verify that the control module features are operational.

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- 3. Check operation of local override controls.
- 4. Test system diagnostics by simulating improper operation of several components selected by facilities.
- D. Install and program software with initial settings of adjustable values. Make backup copies of software and user-supplied values and submit settings list with Testing and Equipment Settings Report. Provide current licenses for software in O&M manuals.
- E. Commissioning Report: Provide Commissioning services required to provide Preliminary and Final Commissioning Report for all Lighting Control Equipment. Preliminary report shall be submitted no later than 90 days of the date of receipt of the certificate of occupancy. Testing and Reports shall be organized and include information as required by the current edition of the IECC.
- F. Testing and training shall be provided at times scheduled with the owner and may need to be done off hours.

3.5 PERSONNEL TRAINING:

- A. Manufacturer's Field Service indicated above shall include Owner's maintenance personnel.
- B. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting controls and software.
- C. Provide extra scheduled time with owner to make corrections to the system to meet the functionality/time control requirements desired by the owner. Record any changes in the Testing and Equipment Settings Report and submit final documents.

END OF SECTION 260923

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SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
 - 1. Receptacles.
 - 2. Ground-fault circuit interrupters.
 - 3. Switches.
 - 4. Wall-plates.
 - 5. Plugs and connectors.

1.2 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 3 years.
- B. Installer's Qualifications: Firm with at least 2 years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- C. Listing and Labeling: Provide products that are listed and labeled for their applications and installation conditions and for the environments in which installed.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code", Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Samples of device plates for color selection and evaluation of technical features shall be submitted.

1.4 COORDINATION:

A. Wiring Devices for Owner Furnished Equipment: Match devices to plug connectors for Ownerfurnished equipment.

WIRING DEVICES

B. Cord and Plug sets: Match cord and plug sets to equipment requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Products shall be of the same manufacturer insofar as possible. Subject to compliance with requirements, provide wiring devices of one of the following:
 - 1. Devices, Cover Plates, Accessories:
 - a. Leviton
 - b. Legrand
 - c. Hubbell

2.2 WIRING DEVICES:

- A. Color selection shall be verified with Architect prior to ordering. Devices shall be. All receptacles and switches connected to circuits served from a generator system shall have a red face.
- B. Receptacles:
 - All duplex, single, Ground Fault Interrupter (GFCI), and other special receptacles shall be minimum, specification grade commercial series, listed by Underwriter's Laboratories, UL 498 and Federal Specification FS W-C-596, 20 amp, nylon face and have a metal mounting strap with self-grounding and have a hex-head green grounding screw and be side and back wired. Each device shall bear the UL/FS Label. Meet NEMA standards for wiring devices including NEMA WD 1 for general requirements and NEMA WD 6 for dimensional standards.
 - a. Each device shall have terminal screws and clamps listed for use with stranded wire. Plug-tail device connections are acceptable.
 - 2. Convenience Receptacle Configuration: Duplex or Single as indicated on the drawings, Type 5-20R.
 - 3. USB Charging: Where indicated with 'USB' on drawings, provide duplex receptacle with (2) built in 2.1 A USB charging ports.
 - 4. Weather Resistant Receptacles: In addition to the above requirements all receptacles in damp and wet locations shall be WR (Weather Resistant) labeled.
 - 5. Special Purpose Receptacle Configuration: straight blade or locking as indicated on drawings, black face.
 - 6. Ground-Fault Interrupter Receptacles: Where indicated or required provide "local reset" auto monitoring "self test" ground-fault circuit interrupters. Provide unit capable of being installed in a 2-3/4" deep outlet box without adapter, grounding type, Class A, Group 1 per UL Standard 943. Provide visual indication of lost protection.
 - 7. Pendant Cord/Connector Devices: Matching, locking type, plug and plug receptacle body connector, NEMA I5-20P and L5-20R, heavy-duty grade.
 - a. Bodies: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.

- b. External Cable Grip: Woven wire mesh type made of high strength galvanizedsteel wire strand and matched to cable diameter and with attached provision designed for the corresponding connector.
- 8. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
 - a. Cord: Rubber-insulated, stranded copper conductors, with type-SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30% minimum.
- Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.
- C. Switches:
 - 1. Wall Switches for Lighting Circuits: NEMA WD1 and WD-6; FS W-S-896E; AC quiet type specification grade commercial series listed by Underwriter's Laboratories with toggle handle, rated 20 amperes at 120-277 volts AC, unless noted otherwise. Mounting straps shall be metal and be equipped with a green hex-head ground screw. Each switch shall bear the UL/FS Label.
 - a. Each device shall have terminal screws and clamps listed for use with stranded wire. Plug Tail device connections are acceptable.
 - b. Pilot Light Type: Where indicated, provide Lighted handle lit when switch is "on."
 - c. Locator Type: Where indicated, and in mechanical rooms, electrical rooms, IT rooms, etc. switches shall be provided with continuously lighted handle. Switches in Hazardous (Classified) Locations: Comply with UL Standard 894, "Switches for Use in Hazardous (Classified) Locations."

2.3 WIRING DEVICE ACCESSORIES:

- A. Verify color and type with Architect prior to ordering. Device color to match Wiring Device Color identified above. Verify location, height, mounting conditions, etc., of all devices with Architectural drawings prior to rough-in.
- B. Wall-plates: Provide wall-plates for single and combination wiring devices, of types, sizes, and with ganging and cutouts as indicated. Select plates which mate and match wiring devices to which attached. Construct with metal screws for securing plates to devices; screw heads colored to match finish of plates. Identify all wall plates used for receptacles with branch circuit number per requirements of section on Electrical Identification. Provide blank wall plates for all cable, data, telephone and junction and outlet boxes. Where cables are routed through the wall-plate, provide grommets in wall-plate openings to protect cables. Provide plates possessing the following additional construction features:
 - 1. Material and Finish. Nylon.
 - 2. Material and Finish: 0.04" thick, type 302 satin finished stainless steel for use in unfinished areas, mechanical, and electrical rooms.
 - 3. Gaskets: Resilient rubber or closed cell foam urethane.
 - 4. Weather Proof, Exterior and other wet locations and where called out on the drawings as "WP", provide weatherproof junction box with gaskets and cover.

- a. "In Use" type: Cover shall be rated "while in use". Use low profile type covers with UV rated and resistant polycarbonate.
- b. Outlet box hood shall be listed as "extra duty".

PART 3 - EXECUTION

3.1 INSTALLATION OF WIRING DEVICES:

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate with other work, including painting, electrical boxes and wiring work, as necessary to interface installation of wiring devices with other work.
- C. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- D. Install wiring devices after wiring work is completed.
- E. Install wall-plates after painting work is completed.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for wiring devices. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds. 486A.
- G. Provide GFCI type outlets as required in NEC 210, including but not limited to: each above counter duplex receptacle shown within 6 feet-0 inches of sinks/lavatories; Bathrooms; Kitchens; Roof Tops; Outdoors; Indoor Wet locations; Locker Rooms; Shower Facilities; vending machines; etc. For above counter multi-outlet assemblies which do not contain duplex receptacles that can be replaced with GFCI devices, provide GFCI circuit breakers on the branch circuit(s) feeding the assembly. Where GFCI devices are required and/or shown but are not readily accessible when equipment is installed, i.e. vending machines, etc., provide blank face GFCI device and cover-plate ahead of inaccessible receptacles. Mount adjacent to equipment at switch height unless otherwise shown. Install individual GFCI devices at each location shown, feed through devices are only acceptable where specifically called for.
- H. Receptacle Mounting: Mount device with front of device flush with the cover plate. Over the counter receptacles shall be mounted horizontally with ground to the right. Where switch and receptacles are mounted within one stud space align vertically. Vertically mounted receptacles shall be mounted with ground up.
- I. Switch Mounting: Switches shall be ganged and within 18" of the door jam on the strike side of the door openings unless otherwise shown. Verify door swings with Architectural drawings prior to rough-in. Switches connected to the life safety system shall not be ganged with other switches. Switch and receptacle combinations shall be installed in 2 gang box where both are of the same voltage. provide separate boxes where different voltages are present.

3.2 PROTECTION OF WALLPLATES AND RECEPTACLES:

A. Upon installation of wall-plates and receptacles, advise Contractor regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

3.3 GROUNDING:

A. Provide equipment grounding connections for wiring devices, unless otherwise indicated. Tighten connections to comply with tightening torques specified in UL Std. 486A to assure permanent and effective grounds.

3.4 CLEANING:

A. Internally clean devices, device outlet boxes and enclosures. Replace stained, cracked, damaged or improperly painted wall plates or devices. Remove temporary markings of labels.

3.5 TESTING:

- A. Prior to energizing circuitry, test wiring for electrical continuity, and for short-circuits. Ensure proper polarity of connections is maintained and prepare test reports. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.
 - 1. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices or similar problems.
 - 2. Tests for Convenience Receptacles:
 - a. Line Voltage: Acceptable range is 114 to 126 V.
 - b. Ground Impedance: Values of up to 2 ohms are acceptable.
 - c. Polarity: Test for correct neutral conduct to neutral terminal connection.
 - d. Using the test plug, verify that the device and its outlet box are securely mounted.
 - e. GFCI Receptacles: Test for tripping values specified in UL 1436 and UL 943. Test with both local and remote fault simulations in accordance with manufacturing recommendations.
 - 3. Test Instruments:
 - a. Use instruments that comply with UL 1436.
 - b. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Correct Deficiencies and Report:
 - 1. Correct unsatisfactory conditions and retest to demonstrate compliance; replace devices as required to bring system into compliance.
 - 2. Correct malfunctioning units on-site, where possible and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Prepare a report that identifies enclosure, units, conductors and devices checked and describe results. Include notation of deficiencies detected, remedial action taken, and observations and test results after remedial action.

END OF SECTION 262726

SECTION 262800 - LOW-VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY:

- A. This section includes overcurrent protective devices (OCPD's) rated 600 V and below and switching devices commonly used with them.
- B. Panelboards, Switchboards, and Motor Control Centers: Application, installation, and other related requirements for overcurrent protective device installations in distribution equipment are specified in other Division 26 sections.

1.2 DEFINITIONS:

- A. Overcurrent Protective Device (OCPD): A device operative on excessive current that causes and maintains the interruption of power in the circuit it protects.
- B. Ampere-Squared-Seconds: An expression of available thermal energy resulting from current flow. With regard to current-limiting fuses and circuit breakers, the ampere-squared-seconds during fault current interruption represents the energy allowed to flow before the fuse or breaker interrupts the fault current within its current limiting range.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product data for fuses, fusible switches, circuit breakers, and OCPD accessories specified in this Section, including descriptive data and time-current curves for all protective devices and let-through current curves for those with current limiting characteristics. Include coordination charts and tables and related data.
- C. Provide Electrical system Arc Flash Study performed by a registered professional engineer in accordance with ANSI/IEEE Standards. Submit a full coordination study with printed labels affixed to each piece of equipment. Include single line diagram with nodes corresponding to the system components, Arc Flash calculations identifying hazard levels, etc. Study shall include all utility systems, overcurrent devices, transformers, buses, generator systems, grounding systems. etc., which comprises the AC power system, Study shall be commissioned and paid for by the Contractor. Submit study with panelboard submittals.
- D. Provide Electrical system Voltage Drop Study by a registered professional engineer in accordance with IECC C405.10. Study shall verify that the maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet shall not exceed 5 percent. Contractor shall specifically indicate the conductors that are to be upsized from the Contract Documents in order to achieve compliance.
- E. Submit documentation of compliance with Code and Specification requirements for circuit protective devices including but not limited to SCCR, Listings for use with downstream

breakers/fuses and equipment where required, Ground Fault protection; Arc Flash reduction for breakers above 1200A; Surge Protection; Metering; Relaying; etc.

1.4 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of overcurrent protective devices of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Each type of OCPD shall be the product of a single manufacturer.

1.5 EXTRA MATERIALS:

A. Spare Fuses: Furnish spares of each type and rating of fuse for fusible devices amounting to one set of 3 fuses for each 9 fuses installed but not less than 3 fuses of each type.

PART 2 - PRODUCTS:

2.1 MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. Cartridge Fuses:
 - a. Bussmann Div., Cooper Industries, Inc.
 - b. Littelfuse Inc.
 - 2. Fusible Switches:
 - a. GE/ABB
 - b. Siemens
 - c. Eaton
 - d. Square D
 - 3. Molded-Case Circuit Breakers:
 - a. Siemens (match existing facility).
 - 4. Combination Circuit Breaker and Ground Fault Circuit Interrupters:
 - a. Siemens (match existing facility).
 - 5. When mounting overcurrent protective devices in switchboards, panelboards, etc., provide equipment of same manufacturer as equipment into which they are being mounted.

2.2 OVERCURRENT PROTECTIVE DEVICES (OCPDS), GENERAL:

- A. General: Provide OCPDs in indicated types, as integral components of panelboards, switchboards, motor control centers, and other related equipment; and also as individually enclosed and mounted single units.
- B. Enclosures: NEMA 250 "Enclosures for Electrical Equipment (1,000 Volts Maximum)."
- C. Where OCPD's are to be installed in existing panelboards, switchboards, and motor control centers, they shall be of the same manufacture and type as those existing in the equipment. If this is not possible, provide devices which are compatible with the existing equipment and when installed will not void the U.L. label or reduce the short circuit rating of the equipment.
- D. All overcurrent devices shall be individually rated for the available fault current unless otherwise noted. Series ratings of equipment will only be allowed where specifically called out.
- E. Ground Fault Protection: Distribution circuit breakers: provide integral, self-powered type with mechanical ground fault indicator, test function, adjustable pick-up current and delay time with inverse and constant time characteristics, internal memory arranged to integrate intermittent arcing ground faults, and ground fault current sensor located as indicated or required. Provide combination devices for branch circuit protection as follows; where shown or required provide 30 mA Ground Fault circuit breakers for each circuit feeding Electrical Heat Trace to protect from overheating and fire and 5 mA Ground Fault circuit breakers for each circuit breakers for each circuit feeding receptacles to protect personnel. Coordinate with manufacturer's instructions.

2.3 CARTRIDGE FUSES:

- A. General: NEMA Standard FU1, "Low-Voltage Cartridge Fuses." Unless indicated otherwise, provide nonrenewable cartridge fuses of indicated types, classes, and current ratings that have voltage ratings consistent with the circuits on which used.
- B. All fuses used for main, feeder, or branch-circuit protection shall be Underwriters Laboratories listed, current-limiting fuses with 200,000 ampere interrupting rating and shall be so labeled. Fuses used for supplementary protection (other than branch circuit protection) shall be as specified above or shall be U.L. approved or component recognized for such purposes. All fuses provided shall be furnished by the same manufacturer. Should equipment provided require a different U.L. Class or size of fuse, the engineer shall be furnished sufficient data to ascertain that system function will not be adversely affected.
- C. In order to simplify fuse replacement, reduce spare fuse inventory and insure adequate thermal protection, all fuses 600 amperes and below shall be true dual-element time-delay fuses with separate spring-loaded thermal overload elements in all ampere ratings. All ampere ratings shall be designed to open at 400 degrees F or less when subjected to a non-load oven test.
- D. To eliminate induction heating, all fuse ferrules and end caps shall be non-ferrous and shall be bronze or other alloy not subject to stress cracking.
- E. Class L Fuses: UL 198C, "High-Interrupting Capacity Fuses, Current-Limiting Type."
- F. Class RK1 Dual Element Time-Delay Fuses: UL 198E, "Class R Fuses."
- G. Class J Low-Peak dual Element Fuse: UL 198C

2.4 NONFUSIBLE SWITCHES:

- A. General: UL 98 "Enclosed and Dead Front Switches" and NEMA KS 1 "Enclosed Switches," quick-make, quick-break heavy-duty units.
- B. Rating: Load-breaking capacity in excess of the normal horsepower rating for the switch.
- C. Withstand Capability: In excess of the available.
- D. Operation: By means of external handle.
- E. Interlock: Prevents access to switch interior except when in "off" position.
- F. Enclosure for Independent Mounting: NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.
- G. Contacts shall be NEMA rated 75 degrees C.
- H. Provide auxiliary contacts for disconnects supplied from variable frequency drives.

2.5 FUSIBLE SWITCHES:

- A. General: UL 98 "Enclosed and Dead Front Switches" and NEMA KS 1 "Enclosed Switches," quick-make, quick-break heavy-duty units.
- B. Rating: Load-breaking capacity in excess of the normal horsepower rating for the switch.
- C. Withstand Capability: In excess of the let-through current permitted by its fuse when subject to faults up to 100,000 RMS symmetrical amperes.
- D. Operation: By means of external handle.
- E. Interlock: Prevents access to switch interior except when in "off" position.
- F. Fuse Clips: Rejection type.
- G. Enclosure for Switchboard or Panel board Mounting: Suitable for panel mounting where indicated.
- H. Enclosure for Independent Mounting: Provide NEMA Type 1 enclosure except as otherwise indicated or required to suit environment where located.
- I. Contacts shall be NEMA rated 75 degrees C.
- J. Provide fuses for safety switches and other equipment of classes, types, and rating needed to fulfill electrical requirements for services indicated.
- K. Provide auxiliary contacts for disconnects supplied from variable frequency drives.

2.6 MOLDED-CASE CIRCUIT BREAKERS:

A. General: UL 489, "Molded Case Circuit Breakers and Circuit Breaker Enclosures," and NEMA AB 1, "Molded Case Circuit Breakers."

- B. Construction: Provide bolt-in type, except breakers 225-ampere frame size and larger which may be plug-in type if held in place by positive locking device requiring mechanical release for removal.
- C. Characteristics: Indicated frame size, trip rating, number of poles, and a short-circuit interrupting capacity rating as indicated or required to match existing devices or equipment.
- D. Tripping Device: Quick-make, quick-break toggle mechanism with inverse-time delay and instantaneous overcurrent trip protection for each pole. Trip unit to be interchangeable within frame sizes for breakers 250 amperes or larger. Breakers 150 amperes and above shall have adjustable trip selection for trip units. All 120/208 volt rated breakers shall be rated and labeled "High Magnetic".
- E. Adjustable Instantaneous Trip Devices: Factory adjusted to low-trip-setting current values. Provide adjustable instantaneous trip devices for each circuit breaker supplying individual motor loads and where indicated.
- F. Enclosure for Switchboard or Panelboard Mounting: Suitable for panel mounting in switchboard or panelboards where indicated.
- G. Enclosure for Switchboard or Motor Control Center Mounting: Provide individual mounting where indicated.
- H. Enclosure for Independent Mounting: NEMA Type 1 enclosure, except as otherwise indicated or required to suit environment where located.

2.7 COMBINATION CIRCUIT BREAKERS AND GROUND FAULT CIRCUIT INTERRUPTERS:

- A. General: UL 943 "Ground Fault Circuit Interrupters," arranged for sensing and tripping for ground fault current in addition to overcurrent and short-circuit current. Provide features as follows:
 - 1. Match features and module size of panelboard breakers and provide clear identification of ground fault trip function.

2.8 CIRCUIT BREAKERS WITH SOLID-STATE TRIP DEVICES:

- A. General: In addition to other requirements as listed, all breakers indicated on the drawings as GFI, all adjustable trip breakers, if required for coordination, and all breakers 250 amp frame size and larger with solid-state trip devices having the following features:
 - 1. Ambient Compensation: Trip device insensitive to temperature changes between minus 20 degrees C and plus 55 degrees C.
 - 2. Adjustability: Breaker ratings and trip settings shall be changeable by operation of controls on front panel of breaker and by change of plug-in element without removing the breaker.
 - a. The trip device sensor shall have the same rating as the frame amperage of the circuit breaker unless noted otherwise.
 - 3. Ground-Fault Tripping: Provide adjustable pick-up and time-delay on circuit breakers indicated with GFI.

2.9 OCPD ACCESSORIES:

- A. Key Interlocks: Arrange interlocking so keys are held captive at devices indicated. Where future key interlocking provisions are indicated, provide necessary mountings and hardware as required for the future installation.
- B. Provide adjustable-time-delay under-voltage trip devices where indicated.
- C. Provide shunt-trip devices for Circuit breakers where required or indicated. Arrange to trip breaker from an external source of power through a control switch or relay contact.
- D. Lock-Out Devices: Provide padlocking provisions on each overcurrent protective device, lockable in the open or closed position. Provide 3 sets of lockout/tagout devices for each type of breaker or switch provided. Include tags, locks and all accessories necessary.

PART 3 - EXECUTION:

3.1 INSTALLATION:

- A. Independently Mounted OCPDs: Locate as indicated and install in accordance with manufacturer's written installation instructions. Install OCPDs level and plumb.
- B. OCPDs in new distribution and branch circuit equipment shall be factory installed. OCPD's in existing distribution and branch circuit equipment shall match existing for type and be provided with features as listed herein.
- C. Install fuses in fusible devices as indicated. Arrange fuses so that fuse ratings are readable without removing fuse.
- D. All fuses for new disconnect switches or MCC's feeding motors or motor starters shall be provided with Class J fuses.
- E. OCPDs and mounting accessories installed in existing equipment shall match the existing manufacturer and be rated for the available fault current.

3.2 IDENTIFICATION:

A. Identify components in accordance with Division 26 Section on electrical identification.

3.3 CONTROL WIRING INSTALLATION:

A. Install wiring between OCPDs and control/indication devices.

3.4 CONNECTIONS:

A. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL 486A and UL 486B.

3.5 GROUNDING:

A. Provide equipment grounding connections for individually mounted OCPD units as indicated and as required by NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.6 FIELD QUALITY CONTROL:

- A. Reports: Prepare written reports on tests and observations. Report defective materials and workmanship and unsatisfactory test results. Include complete records of repairs and adjustments made. Tests shall be made on all new and existing OCPD's provided and/or connected under this project in accordance with this section.
- B. Labeling: Upon satisfactory completion of tests and related effort, apply a label to tested components indicating test results, date, and responsible organization and person.
- C. Schedule visual and mechanical inspections and electrical tests with at least one week's advance notification.
- D. Upon completing installation of the system, perform the following tests on all new equipment and existing equipment as indicated on the drawings:
 - 1. Visual and mechanical inspection: Include the following inspections and related work.
 - a. Overcurrent-Protective-Device Ratings and Settings: Verify indicated ratings and settings to be appropriate for final system arrangement and parameters.
 - b. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.
 - c. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer's instruction manual.
 - d. Check tightness of electrical connections of OCPD's with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
 - e. Clean OCPD's using manufacturer's approved methods and materials.
 - f. Verify installation of proper fuse types and ratings in fusible OCPD's.
 - 2. Electrical Tests: Perform the following tests in accordance with manufacturer's instructions:
 - Insulation resistance test of fused power circuit devices, insulated-case, and molded-case circuit breakers, 600-ampere frame size and over at 1000 degree V D.C. for one minute from pole to pole and from each pole to ground with breaker closed and across open contacts of each phase. Insulation resistance less than 100 megohms is not acceptable.
 - b. Make insulation resistance tests of OCPD buses, components, and connecting supply, feeder, and control circuits.
 - c. Make continuity tests of circuits.
 - d. Provide full rated primary current tests conforming to IETA testing standards of all new breakers 100 amperes and greater, connected under this project. Inspect breakers and provide test report. Set breakers to previous or new settings as directed prior to test.
 - e. Verify relay operation by introduction of accurately metered currents into overcurrent/ground fault/ and other circuitry at values which will enable accurate determination of the tripping or activation values.

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- E. Make adjustments for final settings of adjustable-trip devices.
- F. Activate auxiliary protective devices such as ground fault relays, to verify operation of shunt-trip devices.
- G. Retest: Correct deficiencies identified by tests and observations and provide retesting of OCPDs by testing organization. Verify by the system tests that specified requirements are met.
- 3.7 CLEANING:
 - A. Upon completion of installation, inspect OCPD's. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.
- 3.8 DEMONSTRATION:
 - A. Training: Demonstrate OCPD's and train Owner's maintenance personnel.
 - B. Conduct a minimum of one half day of training in operation and maintenance as specified under in the Project Closeout Section of these specifications. Include both classroom training and hands-on equipment operation and maintenance procedures.
 - C. Schedule training with at least seven days' advance notification.

END OF SECTION 262800

SECTION 265000 - LIGHTING

PART 1 - GENERAL

1.1 SUMMARY:

- A. Extent, location, and details of lighting work are indicated on drawings and in schedules.
- B. Types of lighting in this section include the following:
 - 1. Light Emitting Diode (LED)

1.2 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Shop Drawings: Submit layout drawings of lighting and their spatial relationship to each other. In addition, submit luminaire cut sheets from the manufacturer. For standard products submit shop drawings; for non-standard products submit in booklet form with separate sheet for each luminaire, assembled by "luminaire type" with proposed luminaire and accessories clearly indicated on each sheet. Submit details indicating compatibility with ceiling grid system. Shop drawings shall detail luminaire dimensions, weights, methods of field assembly, mounting components, features and accessories. All features and accessories shall be clearly defined.
- C. Wiring Diagrams: Submit wiring diagrams for lighting showing connections to electrical power panels, switches, dimmers, controllers, and feeders. Differentiate between portions of wiring which are manufacturer-installed and portions which are field- installed.
- D. Samples: Submit one complete operating unit for each type of custom luminaire specified.

1.3 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of lighting of sizes, types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.
- B. Installer's Qualifications: Firms with at least 3 years of successful installation experience on projects with lighting work similar to that required for this project.
- 1.4 DELIVERY, STORAGE, AND HANDLING:
 - A. Deliver lighting in factory-fabricated containers or wrappings, which properly protect luminaires from damage.
 - B. Store lighting in original packaging. Store inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, humidity, laid flat and blocked off ground.

C. Handle lighting carefully to prevent damage, breaking, and scoring of finishes. Do not install damaged units or components; replace with new.

1.5 SEQUENCING AND SCHEDULING:

- A. Coordinate with other work including wires/cables, electrical boxes and fittings, and raceways, to properly interface installation of lighting with other work.
- B. Sequence lighting installation with other work to minimize possibility of damage and soiling during remainder of construction.

1.6 EXTRA MATERIALS:

- A. Drivers: Furnish stock or replacement drivers amounting to 5%, but not less than 2 of each type used in each type luminaire.
- B. Lenses: Furnish stock or replacement lenses amounting to 3%, but not less than one, of each type and size used in each type luminaire.
- C. LED Modules: Furnish replacement modules amounting to 3% of each type.
- D. Deliver replacement stock as directed to Owner's storage space.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

- A. Luminaire Manufacturers: Subject to compliance with requirements, provide luminaires as listed in the luminaire schedule or elsewhere on the drawings or specification.
- B. All other manufacturers shall request prior approval and supply test data from an independent testing laboratory and comparison report to substantiate compliance with specifications and specified equipment.

2.2 EQUIPMENT:

- A. General: Provide lighting of sizes, types and ratings indicated; complete with, but not limited to, housings, energy-efficient lamps, lamp holders, reflectors, energy efficient ballasts, starters and wiring. Ship luminaires factory-assembled, with those components required for a complete installation. Design luminaire with concealed hinges and catches, with metal parts grounded as common unit, and so constructed as to dampen ballast generated noise and as to disconnect ballast when door is opened for HQI lamps.
- B. Lamps:
 - 1. Provide LED's that retain 70% of lamp life after 50,000 hours. LED's shall be binned to NEMA standard SSL 3-2010. The LED light assembly shall be replaceable separate from the luminaire housing. The LED driver shall be dimming where indicated on the drawings. The dimmer switch shall be compatible with the driver, unless otherwise noted.

- a. All LED products and information to be in accordance with IES Standards LM79 & LM80.
- 2. Provide all lamps with CRI 80 or higher unless otherwise indicated. It is important that color fidelity (color rendering aspects of lamp sources) and color appearance (the consistent appearance of the light source) are provided for all lamps.
- C. LED Drivers: THD less than 10%. All 0-10V drivers shall be provided with isolation on the secondary analog side to eliminate secondary voltage on the 0-10V channel.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which lighting is to be installed, and substrate for supporting lighting. Notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 INSTALLATION:

- A. Install lighting at locations and heights as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", NEMA standards, and with recognized industry practices to ensure that lighting fulfills requirements.
- B. Provide luminaires and/or outlet boxes with hangers to properly support luminaire weight. Submit design of hangers, method of fastening, other than indicated or specified herein, for review by Architect.
 - 1. Luminaires shall be positively attached to the suspended ceiling system. The attachment device shall have a capacity of 100% of the luminaire weight acting in any direction.
 - 2. When intermediate systems are used, No. 12 gauge hangers shall be attached to the grid members within 3" of each corner of each luminaire.
 - 3. When heavy-duty systems are used, supplemental hangers are not required if a 48" modular hanger pattern is followed. When cross runners are used without supplemental hangers to support luminaires, these cross runners shall provide the same carrying capacity as the main runner.
 - 4. Luminaires weighing less than 56 pounds shall have, in addition to the requirements above, two No. 12 gauge hangers connected from the luminaire housing to the structure above. These wires may be slack.
 - 5. Luminaires weighing 56 pounds or more shall be supported directly from the structure above by four No. 12 gauge hangers connected from the luminaire housing to the structure above. These wires may be slack.
- C. Install flush mounted luminaires properly to eliminate light leakage between frame and finished surface.
- D. Provide plaster frames for recessed luminaires installed in other than suspended grid type acoustical ceiling systems. Brace frames temporarily to prevent distortion during handling.
- E. Fasten luminaires securely to structural supports; and ensure that pendant luminaires are plumb and level. Provide individually mounted pendant luminaires longer than 2 feet with twin stem

hangers. Provide stem hanger with ball aligners and provisions for minimum one inch vertical adjustment. Mount continuous rows of luminaires with an additional stem hanger greater than number of luminaires in the row.

- 1. Pendant hung luminaires shall be supported directly from the structure above with No. 9 gauge wire or approved alternate support without using the ceiling suspension system for direct support.
- 2. Luminaires mounted in areas of high seismic activity shall be mounted from a rigid stem to restrain sway. If mounted from a non-rigid stem, luminaires to be mounted such that their sway under seismic conditions does not impact another luminaire within 45° swing from nadir.
- F. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Stds 486A and B, and the National Electrical Code.
- G. Support surface mounted luminaires greater than 2 feet in length at a point in addition to the outlet box stud.
- H. Set units plumb, square, level and secure according to manufacturer's written instructions and shop drawings. Refer to specification section 265613, "Poles and Standards" for other requirements.

3.3 FIELD QUALITY CONTROL:

A. At Date of Substantial Completion, replace lamps in lighting which are observed to be noticeably dimmed after Contractor's use and testing, as judged by Architect.

3.4 ADJUSTING AND CLEANING:

- A. Clean lighting of dirt and construction debris upon completion of installation. Clean fingerprints and smudges from lenses and reflectors.
- B. Protect installed luminaires from damage during remainder of construction period.
- C. Adjust aimable luminaires to provide required light intensities and in compliance with design intent.

3.5 GROUNDING:

- A. Provide equipment grounding connections for lighting as indicated. Tighten connections to comply with tightening torques specified in UL Std 486A to assure permanent and effective grounds.
- B. Ground luminaires according to Section 260526, "Grounding," and Section 265613, "Poles and Standards."

3.6 WARRANTY

- A. The Contractor shall guarantee all equipment including ballasts, lamps, luminaires, wiring, etc. free from inherent mechanical and electrical defects. Warranty period shall be from date of acceptance as set forth in the general conditions with periods as follows:
 - 1. Luminaires, wiring, etc. 1 year
 - 2. LED and Driver Five year manufacturer's warranty.

3.7 DEMONSTRATION:

A. Upon completion of installation of lighting and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units, and proceed with retesting.

END OF SECTION 265000

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SECTION 283111 - FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.1 SUMMARY:

- A. Speaker/strobe fire alarm system is to remain and be extended as required for the renovation.
- B. Provide system suitable for type and occupancy as defined by local Building Code,, as approved by local Fire Marshal, local authority having jurisdiction, and as approved by the Director of Facilities Development. Drawings indicate general design intent and do not indicate all equipment or devices or the full extent of the System. Provide complete design of the Fire Alarm System.
- C. Provide an Analog/Addressable System which is defined as a system in which initiating devices and interface modules transmit their address via a binary or multiplex code over a common pair of wires. This address is converted to an English language display giving a custom description for each reporting device. In addition, the system will provide analog information about the sensitivity of each photoelectric, and heat sensing device. The system control panel will maintain a log of this information which can be reviewed on demand. The system will also provide a maintenance alert when the sensitivity of any detector has been outside of a preset range for a period of 24 hours.

1.2 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of fire alarm systems of types, sizes, and electrical characteristics required, and whose products have been in satisfactory use in similar service for not less than 5 years.

Installer's Qualifications: Firm with at least 5 years of successful installation experience on projects with fire alarm systems work similar to that required for this project.

- 1. Firm with manufacturer's factory trained personnel.
- 2. Firm with factory authorized service organization and spare parts stock within 50 miles of the project and with a 24 hour response time.
- 3. Installation shall be accomplished by or supervised by NICET II or higher.
- B. Codes and Standards
 - 1. Each and every item of the fire alarm system shall be listed as the product of a single fire alarm system manufacturer under the appropriate category by Underwriters Laboratory, Inc. (UL) and shall bear the UL label on all devices, appliances and panels comprising the system. All control equipment shall be listed under the category UOJZ as a single control unit and cross listed with the base loop fire alarm system. Partial listings shall be unacceptable.
 - 2. The complete installation shall conform to the applicable sections of NFPA and Local Code Requirements, and the National Electrical Code with particular attention to article 760. All control equipment must have transient protection to comply with UL 864 requirements or Standard #497B as applicable.

- 3. FM Compliance: Provide fire alarm systems and accessories which are FM approved.
- 4. The fire alarm system and devices shall comply with ADA 1990 and UL 1971 requirements.

1.3 SUBMITTALS:

- A. See Section 26 05 00 Common Work Results for Electrical for Submittal requirements. Supplemental information is listed within this section.
- B. Product Data: Submit manufacturer's technical product data including specifications, data sheets, wiring diagrams, equipment ratings, dimensions, finishes, and description of system operation.
- C. Shop Drawings: Provide shop drawing submittal for approval by the local Fire Department and/or The Authority having jurisdiction. The Contractor shall arrange to have the Fire Alarm System shop drawing submittal prepared, sealed, and signed by a professional engineer and NICET III or NICET IV in Fire Alarm Systems if/as required by the authority having jurisdiction. Preparer shall assume the duty of Engineer of Record for the Fire Alarm System design. Provide shop drawings showing system components, including panels and cabinets, locations, quantities, and full schematic of system wiring showing conductor routings and quantities, and connection details. Provide updated room names and numbers that match the names and numbers as labeled at the building. Room names and numbers shown on the contract documents are not necessarily those that are currently being used in the building. The fire alarm manufacturer shall coordinate with the contractor and owner on existing and new work and survey the site on existing work to identify the proper names and numbers. All conduit routing must be submitted to, and accepted by, the Architect/Engineer. Shop drawing documents must be submitted simultaneously with sprinkler system documents and prior to installation.

This information shall be submitted on 1/8 inch = 1 foot scale building floor plans. No other systems shall be included on these plans. Reproduction of contract drawing will not be acceptable. The following information shall be included in the shop drawings:

- 1. Occupancy group and use.
- 2. Number of stories.
- 3. Indicate extent of building sprinkler system.
- 4. Indicate addition to/modifications of existing system.
- 5. One-line diagram showing/indicating number of devices and appliances per zone/circuit.
- 6. Wire sizes, color coding, type(s) and voltage drop calculations.
- 7. Indicate annunciation method and include graphic zone map.
- D. Submit manufacturer's installation instructions, including outlet or back box requirements for each piece of equipment.
- E. Submit manufacturer's certificate that system meets or exceeds specified requirements.
- F. Submit sequence of operation and verification of system operation by manufacturer or his authorized representative.
- G. Submit back-up battery calculations.
- H. All shop drawings, battery and voltage drop calculations shall be submitted to the authority having jurisdiction for review after review by the Architect/Engineer.
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- I. Submit graphic annunciator and/or map layouts for review by the Architect/Engineer prior to fabrication.
- J. Indicate whether fire alarm system is required or non-required and list code sections required by and applicable to.
- K. List all variances and attach as required.
- L. Include brief description of scope of work.
- M. Submit Zone schedule.
- N. Submit device address schedule.
- O. Submit interior and exterior front elevations of the FACP and exterior front elevations of other panels.

1.4 DELIVERY, STORAGE, AND HANDLING:

- A. Handle fire alarm equipment carefully to prevent damage, breaking, and scoring. Do not install damaged equipment or components; replace with new.
- B. Store fire alarm equipment in clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

1.5 OPERATION:

A. The existing system operation shall be maintained and extended.

1.6 SUPERVISION

- A. There shall be supervisory service initiation device circuits for connection of all sprinkler valve supervisory switches (tamper). Device activation shall cause a supervisory alarm at the control panel.
- B. There shall be independently supervised and independently fused indicating appliance circuits for alarm speakers and flashing alarm lamps. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- C. Auxiliary manual control shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble.
- D. Each independently supervised circuit shall include a discrete LCD readout to indicate disarrangement conditions per circuit.
- E. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the control panel and the remote annunciator. A green "power on" LED shall be displayed continuously while incoming power is present.
- F. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the control panel.

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- G. The System Modules shall be electrically supervised for module placement. Should a module become disconnected the system trouble indicator shall illuminate and the audible trouble signal shall sound.
- H. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, provide fire alarm systems by the following:
 - 1. Edwards
- B. Fire Alarm Cable
 - 1. West Penn
 - 2. Belden
 - 3. Annixter

2.2 FIRE ALARM AND DETECTION SYSTEMS:

- A. General: Provide complete fire alarm products of types, sizes and capacities indicated, which comply with manufacturer's standard design, materials, components; construct in accordance with published product information, and as required for complete installation. Provide fire alarm and detection systems for applications indicated.
- B. Wiring System Materials: Provide basic wiring materials which comply with Division-26 sections; "Raceways", Wires and Cables" and "Electrical Boxes and Fittings".
 - 1. Provide wire and cable in accordance with requirements of manufacturer. Wire insulation shall comply with NEC Article 760.
 - 2. Provide individual solid copper conductor sizes AWG #14, or larger.
 - 3. Provide multi-conductor cables for wire sizes smaller than AWG #16.
 - 4. Provide conductors which are UL listed for the installation and location, and approved for fire alarm usage.
 - 5. Initiating circuits shall be color coded red for positive, red with black stripe for negative. Indicating circuits shall be color coded red with yellow stipe for positive, red with brown stripe for negative.
 - 6. All conductors shall be numbered and their numbers shall correspond to the terminal block numbering they are connected to. Provide conductor wiring and terminal block numbering.
 - 7. Wiring styles shall be as follows: Class B-IDC, Class B, Style 4-SLC, Class B-NAC. Style D-IDC between buildings.
 - 8. Provide multiple audible zones and alternate zones per floor.
- C. Power Requirements:

- 1. The control panel shall receive 120 VAC power via a dedicated circuit. The system shall include an integral, transient voltage surge suppression device (SPD) on the incoming 120- volt power. SPD device shall be UL 1449 rated for 380 volts/Type B.
- 2. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal supervisory mode for a period of 24 hours with 15 minutes of alarm operation at the end of this period. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic.
- 3. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the control panel.

2.3 ADDRESSABLE COMMUNICATION NETWORK:

- A. The system must provide communication with addressable initiating and control devices individually. Each of these devices will be individually annunciated at the control panel. Annunciation shall include the following conditions for each point:
 - 1. Alarm
 - 2. Trouble
 - 3. Open
 - 4. Short
 - 5. Device missing/failed
- B. All addressable devices shall have the capability of being disabled or enabled individually.
- C. Systems that require factory reprogramming to add or delete devices are unacceptable.
- D. The communication format must be a completely digital poll/response protocol to allow ttapping of the circuit wiring.
- E. Each addressable device must be uniquely identified by an address code entered on each device at time of installation. The use of jumpers to set address will not be acceptable. Device identification schemes that do not use uniquely set addresses but relay on electrical position along the communication channel are unacceptable.
- F. There shall be no limit to the number of detectors, zone adapter modules, or stations which may be activated or "IN ALARM" simultaneously.
- G. All devices shall be supervised for trouble conditions. The system control panel will display the type of trouble condition in plain English. Should any device fail, it will not prevent the operation of other devices.
- H. Spare capacity shall be provided to allow for 20 percent more addressable points to be added to the fire alarm system without adding additional components after system is complete.

2.4 ADDRESSABLE DEVICE TYPES:

- A. General: Devices will be located as shown on the drawings. The location of addressable devices will be selected to optimize the system layout in order to provide the level of protection, zone identification and control as shown on the drawings.
- B. Environmental Compensation Analog Sensors:

- Smoke sensors shall be a smoke density measuring device having no self-contained alarm set point. The alarm decision for each sensor shall be determined by the control panel. The control panel shall determine the condition of each sensor by comparing the sensor value to stored values. The control panel shall maintain a moving average of the sensors smoke chamber value. Systems that do not automatically maintain a constant smoke obscuration sensitivity for each sensor by compensating for environmental factors are deemed unacceptable.
- 2. The detector shall automatically indicate when an individual sensors needs cleaning. When a sensor's average value reaches a predetermined value, a "Dirty Sensor" trouble condition shall be audibly and visually indicated at the control panel. Additionally, the LED on the sensor base shall glow steady giving a visible indication at the sensor location. If a "Dirty Sensor" is left unattended, and its average value increases to a second predetermined value, an "Excessively Dirty Sensor" trouble condition shall be indicated at the control panel for the individual sensor.
- 3. The control panel shall automatically perform a daily self-test on each sensor. Checking the electronics in the sensor's base ensures the accuracy of the values being transmitted to the control panel. A sensor that fails the self-test will cause a "Self-Test Abnormal" trouble condition at the control panel. A sensor self-test which must be manually initiated by the operator shall not be acceptable.
- C. Addressable Detector Bases: All addressable smoke and heat detector heads will plug into their bases. The base will contain electronics that communicate the detector status (normal, alarm, trouble) to the control panel over two wires. The same two wires shall also provide power to the base and detector. Detector heads (smoke or heat) must be interchangeable. Upon removal of the head, a trouble signal will be transmitted to the control panel.
- D. Photoelectric Detector Head: Photoelectric type detectors shall be of the solid state photoelectric type and shall contain no radioactive material. They will use a pulsed infrared LED light source and be sealed against rear air flow entry. The detector shall fit into an addressable base that is common with both the heat and photoelectric type detectors.
- E. Thermal Detector Head: Thermal detector heads must be UL listed. They will be a combination rate-of-rise and fixed temperature (135 degrees F) type, automatically restorable unless fixed temperature (190 degrees F.) type are specifically required. The detector shall fit into an addressable base that is common with both the photoelectric and ionization type detectors. Provide addressable module for automatic restoring detectors that are not addressable.
- F. Pull Stations: Pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. The address will be set on the station. They will be manufactured from high impact red Lexan. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations will be single/double action. The front of the station is to be hinged to a back-plate assembly and must be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall be Underwriters' Laboratories Inc. listed for operation with the control panel.
- G. Duct Smoke Detectors: The detector shall be non-polarized 24VDC type which is compatible with the fire alarm panel and obtains its operating power from the supervisory current of the addressable loop. The detector head shall be the same as the addressable photoelectric detector heads used in the rest of the system. Provide duct detectors compatible with the air velocities within the duct to be installed (i.e. for low velocity ducts, provide an in-duct style detector). It shall be possible to test the detector by use of a remote alarm test switch. The duct detector housing shall contain the addressable electronics necessary to communicate with the control panel. For maintenance purposes, it shall be possible to clean the sampling

tubes by access through the detector housing. To minimize false alarms, voltage and transient suppression techniques shall be employed as well as automatic alarm verification circuitry and insect screens.

- 1. Each duct detector shall be provided with a remote alarm LED indicator and a Magnet Type RTS. Plates shall be labeled with the name of the device/equipment served.
- 2. Interlock each fan with its associated duct detector.
- 3. Provide access door(s) for in-duct style duct detectors.
- H. Adaptor Module: Adapter Modules shall be used for monitoring of water flow, valve tamper, non-addressable detectors, and for control of smoke dampers, door holders, and other output control functions. Adapter Modules will be capable of mounting in a standard electric outlet box. Adapter Modules will include cover plates to allow surface or flush mounting. Adapter Modules will receive their 24VDC power from a separate two wire pair running from an appropriate power supply. There shall be two types of devices: Type 1; Monitor Adapter Modules for conventional 2-wire thermal detector and/or contact device monitoring with Class B or Class A wiring supervision. Type 2; Control Adapter Modules for signals, speakers, fire fighter phone jacks and other device control with Class B or Class A wiring supervision.
 - 1. Air Handling Equipment: Provide modules as required for monitor and control of Air Handling units such that the unit shall shut down upon detection of smoke at the unit or from any detector alarm within the space. Provide relays as required.
 - 2. Provide modules as required to monitor existing hardwired zones. Existing zone quantities and configurations shall remain, unless otherwise indicated or shown on the plans.

2.5 ALARM SIGNAL DEVICES:

- A. Fire Alarm Speaker/Strobe Combination: Provide high impact resistant red LEXAN speaker/strobe combination devices as shown on the plans. Each assembly shall consist of two independent devices which are manufactured as compatible with each other and with the control equipment. Each assembly shall provide a terminal strip or wire leads for true in-out wiring connections. The strobe unit shall have a candela-second rating in compliance with ADA requirements and be rated at 24 VDC.
 - 1. Housings shall be white unless otherwise noted.
 - 2. Exterior-mounted devices shall have red housing.
 - 3. Strobes shall be clear with red letters "FIRE" on two sides.
 - 4. Provide wall mounting as shown on the plans. Verify manufacturer mounting requirements prior to rough in.
- B. Individual Strobe Unit: Provide strobe units mounted where shown. Units shall match those used in the combination speaker/strobe specified.
- C. Where multiple strobe units are visible from a single location and the potential visible flash rate is 5 hz or more, provide synchronizing modules and strobes compatible for synchronizing as required. Provide additional wiring, conduit, and power supplies as necessary.
- D. Speakers have been located on the drawings. It is the Contractor's responsibility to provide adequate coverage to achieve the required 15 dBA above ambient at all locations throughout the building. If locations shown are inadequate, provide additional speakers on shop drawing submittal. Additional speakers will be added at no additional cost to the contract including

conduit wiring, power supplies, etc. System shall meet NFPA 72 Intelligibility Standards required by AHJ.

- 2.6 AUXILIARY DEVICES/EQUIPMENT:
 - A. Magnetic Door Holder Devices: Provide door holders as shown on the plans. Release of doors occurs on a verified alarm or after a general AC power failure in the building. Coordinate all door hardware with door hardware supplier if applicable.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Examine areas and conditions under which fire alarm systems are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.2 IDENTIFICATION:

A. Provide electrical identification in accordance with Division-26 section on Electrical Identification. SLC and NAC Devices shall be labeled with System Device Address and EOL locations shall be identified at each EOL device.

3.3 INSTALLATION OF BASIC WIRING SYSTEM MATERIALS:

- A. Install all wiring in raceways.
- B. Install wiring, raceways, and electrical boxes and fittings in accordance with Division 26 sections; "Raceways", "Wires and Cables", and "Electrical Boxes and Fittings".
- C. Install wiring in exposed ivory colored surface metal raceway where specifically noted as allowed on wall or ceilings.
- D. Install wires and cables without splices. Make connections at terminal strips in cabinets or at equipment terminals. Make soldered splices in electronic circuits in control cabinets.
- E. Smoke Compartments/High Rise: Protect all notification appliance circuits (NAC) devices by a 2-hour protected assembly in compliance with UL 2196 from the FACP until they enter the signaling zone that they serve.

3.4 INSTALLATION OF FIRE ALARM SYSTEMS:

- A. Install fire alarm system as indicated, in accordance with equipment manufacturer's written instructions and complying with applicable portions of NEC and NECA's "Standard of Installation."
- B. Wiring: Wiring of fire alarm system is not specifically detailed on drawings. Refer to the manufacturer's shop drawings for detailed wiring and connection information.

- 1. Complete wiring in accordance with manufacturer's requirements. Provide Striped Color coded wiring and install per manufacturer's point-to-point wiring diagram. Determine exact number of wires for each fire area zone from number and types of devices installed. Connect each device with sufficient wiring to complete its intended operation.
- 2. Where there are a number of power requiring devices such as smoke detectors, fan relays, door holders and smoke damper operators installed in a circuit, group in numbers so power required does not exceed 80 percent of manufacturer's power supply rating. Provide extra wiring, or extra power supplies required to fulfill that requirement. In addition, provide extra or larger size wiring to alleviate voltage drops which makes device operate beyond voltage limits for which it was designed. Determine above with manufacturer's representative while equipment is being installed.
- 3. Where an existing system is present it shall remain in operation while the new system is being installed, tested, and accepted.
- 4. Mount audible and visual devices per Americans with disabilities Act (ADA) 1990 requirements.
- 5. SLC T-Tapping is acceptable, IDC and NAC T-Tapping is not allowed.

3.5 FIELD QUALITY CONTROL:

- A. Connection and Supervision: Make connections to panel under manufacturer's supervision. Run wiring to main terminal cabinet located adjacent to main fire alarm panel. Complete connections from this cabinet to panel utilizing Manufacturer's technicians.
- B. System Test and Approval: Submit shop drawings for function and operation only, pre-approved by authority having local jurisdiction.
 - 1. Prior to final acceptance of system, manufacturer shall, in presence of Contractor and Owner's Representative, test each sensing or detection and alarm device including devices and equipment interlocks such as equipment shutdown and smoke dampers. Schedule test with Owner prior to testing.
 - 2. The completed fire alarm system shall be fully tested in accordance with NFPA-72 by the contractor in the presence of the Owner's representative and the Local Fire Marshal. Upon completion of a successful test, the contractor shall so certify in writing to the owner and general contractor.
 - 3. The contractor shall coordinate the testing of each fire alarm detector added or relocated under this project with the fire department and forward a completed checklist showing each detector operated properly and that proper indication of detector operation occurred at all control panels, annunciator panels, remote indicators, remote test switches, etc. In addition, proper interlocks, door release, etc. shall be documented with specific equipment affected listed by identifier.
 - 4. Submit copy of test results in duplicate after signed by Owner's Representative to Architect/Engineer, Owner, and local Fire Protection Authority. Mount copy of inspection record in Lexan enclosed frame assembly on control panel.
 - 5. Provide Record of Completion Documentation per NFPA-72.

3.6 MAINTENANCE CONTRACT:

A. The equipment manufacturer shall make available to the owner a maintenance contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72 guidelines.

3.7 WARRANTY:

A. The Contractor shall guarantee all equipment and wiring free from inherent mechanical and electrical defects for a period of one year from the date of acceptance as set forth in the general conditions.

3.8 OPERATING AND MAINTENANCE INSTRUCTIONS:

On completion of the work, the equipment manufacturer shall provide training for two maintenance personnel to a level equal to a "Factory-Certified Technician". The training shall be conducted at the vendor's local office or the Factory.

3.9 PAINTING AND PATCHING:

- A. Contractor shall paint all exposed conduit to match adjacent surfaces. All surfaces or finishes damaged as a result of this work shall be properly patched, painted and/or repaired by trained craftsmen of the trade involved.
- B. Blank plates shall be painted to match adjacent surfaces.

END OF SECTION 283111