



2039 Kennedy Boulevard  
Jersey City, New Jersey  
07305-1597  
(201) 200-3159

# **DIVISION 0**

**NEW JERSEY CITY UNIVERSITY  
2039 KENNEDY BOULEVARD  
JERSEY CITY, NEW JERSEY 07305-1597**

## **NURSING EDUCATION CENTER**

**PROJECT No. 4131  
BID No. 17-024**

**December 4, 2017**

**PROJECT MANUAL**

**NURSING EDUCATION CENTER  
NEW JERSEY CITY UNIVERSITY**

2039 KENNEDY BOULEVARD  
JERSEY CITY, NJ 07305

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Purposefully Not Used

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G-003	PHASING PLAN
G-010	PARTITION TYPES & GENERAL DETAILS

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A-901	FOURTH FLOOR SIGNAGE PLAN
A-902	FIFTH FLOOR SIGNAGE PLAN
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## **SECTION 00 01 50 – CONTRACT DRAWINGS**

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P-102	FIFTH FLOOR PLUMBING PLANS
P-103	SIXTH FLOOR PLUMBING PLANS
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FP-102	FIFTH FLOOR FIRE PROTECTION PLANS
FP-103	SIXTH FLOOR FIRE PROTECTION PLANS
FP-200	FIRE PROTECTION DETAILS

The Architect may furnish additional drawings as may be required for further explanation of details for work under this Contract, but these drawings will not include shop drawings. Shop Drawings shall be



**SECTION 00 01 50 – CONTRACT DRAWINGS**

completed and submitted for Architect's review for compliance with the contract documents prior to the starting of work by the Contractor, as specified herein.

END OF SECTION 000150

**GENERAL CONTRACTOR CHANGE ORDER PROPOSAL FORM**

Contractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

**SECTION A: DETAILED DESCRIPTION OF THE WORK:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

SECTION B: SELF PERFORMED WORK	CM REVISIONS	
1. Total Labor (from Labor Worksheet)	\$0.00	
2. Total Material (from Material Worksheet)	\$0.00	
3. Total Equipment (from Equipment Expense Proposal)	\$0.00	
<b>4. Subtotal (total lines 1 through 3)</b>	<b>\$0.00</b>	
5. Contractor's Mark-up Combined Overhead and Profit (10% of line 4)	\$0.00	
<b>6. SELF PERFORMED WORK TOTAL (Total lines 4 and 5)</b>	<b>\$0.00</b>	

SECTION C: SUBCONTRACTOR WORK	(From Subcontractor's Proposal - provide subcontractor proposal forms)	
7. Names of Subcontractors:	Line 11 from Sub Form	5% Markup
A. _____		\$0.00
B. _____		\$0.00
C. _____		\$0.00
D. _____		\$0.00
<b>8. TOTAL SUBCONTRACTORS' PROPOSALS</b>	<b>\$0.00</b>	<b>\$0.00</b>
9. General Contractor's 5% Markup on Subs' Cost		\$0.00
<b>10. SUBCONTRACTOR TOTAL</b>		<b>\$0.00</b>

<b>SECTION D: CONTRACTOR'S REQUESTED TOTAL</b>		
11. General Contractor's 2% Markup For Insurances & Bonds		\$0.00
<b>12. AMOUNT REQUESTED</b> (Total lines 6, 10, and 11)		<b>\$0.00</b>

\_\_\_\_\_  
 Signature of Contractor's Authorized Representative      Date

\_\_\_\_\_  
 Print Name

\_\_\_\_\_  
 Print Title

**SECTION E: OWNER REPRESENTATIVE'S REVIEW**

I have reviewed the labor hours, material quantities and equipment and (check one):

\_\_\_\_\_ no exceptions are taken to this Proposal.  
 \_\_\_\_\_ see comments noted on proposal or below.

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

By: \_\_\_\_\_  
 Owner's Representative      Date

**New Jersey City University**  
**Project - Nursing Education Center**

NJCU Project No. 17-024

Change Request No. \_\_\_\_\_

Date: \_\_\_\_\_

**GENERAL CONTRACTOR CHANGE ORDER LABOR WORKSHEET**

Contractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

STRAIGHT TIME LABOR AND PREMIUM PORTION OF OVERTIME (PPO)								CM USE ONLY
Work Description	Trade	Straight Time Hrs	Straight Time Rate	Overtime Hrs	Overtime Rate	Straight Time Cost	PPO Cost	CM Revisions
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
<b>SUBTOTALS</b>						\$0.00	\$0.00	
						<b>TOTAL LABOR</b>	\$0.00	

**GENERAL CONTRACTOR CHANGE ORDER MATERIAL WORKSHEET**

Contractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

					CM USE ONLY
Material Description	Quantity	Unit	Unit Cost	Material Cost	CM REVISIONS
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
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				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
<b>TOTAL MATERIAL COST</b>				<b>\$0.00</b>	

**New Jersey City University**  
**Project - Nursing Education Center**

NJCU Project No. 17-024

**Change Request No.** \_\_\_\_\_  
**Date:** \_\_\_\_\_

**GENERAL CONTRACTOR CHANGE ORDER EQUIPMENT EXPENSE PROPOSAL**

Contractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

- |  |                                   |
|--|-----------------------------------|
| 1. For <b>self-owned</b> equipment calculate rate in column 6.<br>2. <b>Rented</b> equipment will be paid for at actual cost. Complete columns 1, 3, 4 and 11.<br><i>Include a copy of the rental invoice or quote.</i><br>3. Operating cost includes fuel and lubricants but does not include operator's wages.<br>4. Minor Equipment and hand tools are considered overhead costs and cannot be claimed. | Comments: _____<br>_____<br>_____ |
|--|-----------------------------------|

1	2	3	4	5	6	7	8	9	10	11
Indicate if Owned or Rented	Reference Page from Blue Book	<b>Complete equipment Description</b> Year, Make, Complete Model No., Size, Capacity, H.P., GWV Fuel Type used or other information to completely describe the equipment used.	Hours Required on Site	Monthly Rate	Hourly Rate (Column 5 divided by 176 hrs/Mo.)	Equipment Expense (Column 4 multiplied by Column 6)	Actual Operating Hours	Hourly Operating Cost (Rate from Blue Book)	Total Operating Cost (Column 8 multiplied by Col. 9)	<b>Total Equipment Cost</b> Sum of Column 7 and Col 10 or Total Rental Cost
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
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					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
<b>TOTAL CONTRACTOR EQUIPMENT EXPENSE</b>										<b>\$0.00</b>

**SUBCONTRACTOR CHANGE ORDER PROPOSAL FORM**

Subcontractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

**SECTION A: DETAILED DESCRIPTION OF THE WORK:** \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

SECTION B: SELF PERFORMED WORK		CM REVISIONS	
1. Total Labor (from Labor Worksheet)		\$0.00	
2. Total Material (from Material Worksheet)		\$0.00	
3. Total Equipment (from Equipment Expense Proposal)		\$0.00	
<b>4. Subtotal (total lines 1 through 3)</b>		<b>\$0.00</b>	
5. Subcontractor's Mark-up Combined Overhead and Profit (10% of line 4)		\$0.00	
<b>6. SELF PERFORMED WORK TOTAL (Total lines 4 and 5)</b>		<b>\$0.00</b>	

SECTION C: SUB-SUBCONTRACTOR WORK		<i>(From Subcontractor's Proposal - provide subcontractor proposal forms)</i>	
7. Names of Subcontractors:		5% Markup	
A. _____		\$0.00	
B. _____		\$0.00	
C. _____		\$0.00	
D. _____		\$0.00	
8. TOTAL SUBCONTRACTORS' PROPOSALS	<b>\$0.00</b>	<b>\$0.00</b>	
9. Subcontractor's 5% Markup on Sub-Subcontractors' Cost		\$0.00	
<b>10. SUB-SUBCONTRACTOR TOTAL</b>		<b>\$0.00</b>	

SECTION D: SUBCONTRACTOR'S REQUESTED TOTAL	
<b>11. AMOUNT REQUESTED</b>	<b>\$0.00</b> (Total lines 6 and 10)

Signature of Subcontractor's Authorized Representative \_\_\_\_\_ Date \_\_\_\_\_  
 \_\_\_\_\_  
 Print Name  
 \_\_\_\_\_  
 Print Title

**SECTION E: OWNER REPRESENTATIVE'S REVIEW**  
 I have reviewed the labor hours, material quantities and equipment and (check one)  
 \_\_\_\_\_ no exceptions are taken to this Proposal.  
 \_\_\_\_\_ see comments noted on proposal or below.  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 By: \_\_\_\_\_  
 Owner's Representative Date

**New Jersey City University**  
**Project - Nursing Education Center**

NJCU Project No. 17-024

**Change Request No.** \_\_\_\_\_

**Date:** \_\_\_\_\_

**SUBCONTRACTOR CHANGE ORDER LABOR WORKSHEET**

Subcontractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

STRAIGHT TIME LABOR AND PREMIUM PORTION OF OVERTIME (PPO)								CM USE ONLY
Work Description	Trade	Straight Time Hrs	Straight Time Rate	Overtime Hrs	Overtime Rate	Straight Time Cost	PPO Cost	CM Revisions
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
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						\$0.00	\$0.00	
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						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
						\$0.00	\$0.00	
<b>SUBTOTALS</b>						\$0.00	\$0.00	
						<b>TOTAL LABOR</b>	\$0.00	

**SUBCONTRACTOR CHANGE ORDER MATERIAL WORKSHEET**

Subcontractor Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 Telephone No.: \_\_\_\_\_

					CM USE ONLY
Material Description	Quantity	Unit	Unit Cost	Material Cost	CM REVISIONS
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
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				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
				\$0.00	
<b>TOTAL MATERIAL COST</b>				<b>\$0.00</b>	



**SUBCONTRACTOR CHANGE ORDER EQUIPMENT EXPENSE PROPOSAL**

Subcontractor Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Telephone No.: \_\_\_\_\_

1. For **self-owned** equipment calculate rate in column 6.
2. **Rented** equipment will be paid for at actual cost. Complete columns 1, 3, 4 and 11.  
*Include a copy of the rental invoice or quote.*
3. Operating cost includes fuel and lubricants but does not include operator's wages.
4. Minor Equipment and hand tools are considered overhead costs and cannot be claimed.

Comments: \_\_\_\_\_

1	2	3	4	5	6	7	8	9	10	11
Indicate if Owned or Rented	Reference Page from Blue Book	<b>Complete equipment Description</b> Year, Make, Complete Model No., Size, Capacity, H.P., GWV Fuel Type used or other information to completely describe the equipment used.	Hours Required on Site	Monthly Rate	Hourly Rate (Column 5 divided by 176 hrs/Mo.)	Equipment Expense (Column 4 multiplied by Column 6)	Actual Operating Hours	Hourly Operating Cost (Rate from Blue Book)	Total Operating Cost (Column 8 multiplied by Col. 9)	<b>Total Equipment Cost</b> Sum of Column 7 and Col 10 or Total Rental Cost
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
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					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
					\$0.00	\$0.00			\$0.00	\$0.00
<b>TOTAL SUBCONTRACTOR EQUIPMENT EXPENSE</b>										<b>\$0.00</b>

**NEW JERSEY CITY UNIVERSITY**  
**EQUIVALENT REQUEST FOR APPROVAL**

**PROJECT NAME:** Nursing Education Center  
**NJCU PROJECT #:** 17-024

Submit a copy of this form for each request. Fill in all blanks, check all boxes that apply and attach all necessary supporting data.

Specified Item: \_\_\_\_\_  
Specification Section(s)/Paragraph(s): \_\_\_\_\_  
Drawing Number(s): \_\_\_\_\_  
Proposed Equivalent: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(include, as applicable, manufacturer's name & address, trade name & model number of product and name of fabricator or supplier)

Reason for Proposed Equivalent: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

The following required supporting documents are attached (Check all that apply):

- Complete Product Data
- Itemized comparison of properties of proposed product to specified product.
- List of other projects on which proposed has been used, with project name, design professional's name and owner contact.
- List of maintenance services and replacement materials available.
- Description of change that will be required in other work or products if proposed product is approved.
- Cost savings to change

The undersigned testifies that he/she:

- Is submitting this request within the limits set forth in the Contract Documents.
- Has investigated the proposed product and determined that it is equivalent or better than the specified product.
- Will provide the same warranty for the proposed product as for the specified product.
- Will coordinate installation and make other changes as required for the work to be complete in all respects, including: (a) redesign and (b) additional components and capacity required by other work affected by the proposed product.

Contractor's Signature: \_\_\_\_\_

Typed or Printed Name: \_\_\_\_\_

Title: \_\_\_\_\_

Company: \_\_\_\_\_

**NEW JERSEY CITY UNIVERSITY**

**RETAINAGE BOND FORM**

BOND NO. \_\_\_\_\_

**KNOW ALL PERSONS BY THESE PRESENTS that [NAME OF CONTRACTOR],** as Principal, and the undersigned surety, are held and firmly bound unto NEW JERSEY CITY UNIVERSITY as Obligee, in the amount of TWO PERCENT (2%) of the total amount paid the Principal under the contract, including any increases due to change orders, quantities of work, new items of work, or other additions as the Obligee may pay under the Contract, lawful money of the United States, well and truly to be paid to NEW JERSEY CITY UNIVERSITY, and we bind ourselves, our heirs, successors, executors, and administrators jointly and severally, firmly by these presents.

Whereas, the Principal has entered into a contract for the above-referenced project with NEW JERSEY CITY UNIVERSITY and;

Whereas, under the contract, the Principal is required before commencing the work provided for in the contract to execute a bond in the above amount;

Now therefore, the condition of this obligation is such that if the Principal and its heirs, successors, executors, and administrators shall fully indemnify and save harmless NEW JERSEY CITY UNIVERSITY from all costs and damages from valid claims filed within 90 days of notification of final acceptance of the work under the contract by any person or entity against the contract funds, and shall fully reimburse NEW JERSEY CITY UNIVERSITY for amounts owed by the **Principal** to NEW JERSEY CITY UNIVERSITY with regard to the contract after notification of final acceptance of the work, then this obligation shall be null and void, otherwise it shall remain in full force and effect.

Provided further, that the said surety(ies) for value received, hereby stipulates and agrees that no change, extension of time, alteration, or addition to the terms of the Contract, or to the work to be performed thereunder, or the Specifications accompanying the same, shall in anywise affect its obligation on this bond. The surety(s) does hereby waive notice of any such change, extension of time, alteration or addition, to the terms of the Contract or to the work or to the Specifications, unless otherwise specified in the contract.

**WITNESS** our hand this, \_\_\_\_\_ day of \_\_\_\_\_, 2018.

**CONTRACTOR**

\_\_\_\_\_  
(Firm Name and Seal)

\_\_\_\_\_  
(Print Name and Title)

\_\_\_\_\_  
(Signature)

**SURETY**

\_\_\_\_\_  
(Firm Name and Seal)

\_\_\_\_\_  
(Print Name and Title)

\_\_\_\_\_  
(Signature)

\*NOTE: A Power of Attorney, showing that the surety officer or Attorney-In-Fact has authority to sign such obligation, must be impressed with the corporate seal and attached behind the Retainage Bond in each contract.

## **SECTION 00 70 00 – GENERAL CONDITIONS**

### **PART 1 - GENERAL**

#### 1.1 SECTION INCLUDES

A. New Jersey City University General Conditions

#### 1.2 GENERAL CONDITIONS

A. Attached are the New Jersey City University contract general conditions (pages 1 through 89).

**- END OF SECTION 00 70 00 -**

**State of New Jersey  
New Jersey City University  
Construction Contract:  
General Conditions**

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## ARTICLE 1

### CONTRACT DOCUMENTS

#### 1.1 DEFINITIONS

1.1.1 ADDENDA/ BULLETIN: Written supplemental instructions issued after the plans and specifications are issued for bid, and prior to bid opening. These become part of the contract at time of execution, having been acknowledged on the Bid Form.

1.1.2 CONTRACT DOCUMENTS: Consist of the Agreement (Contract), Bid Advertisement (Invitation To Bid), Instructions to Bidders, Bid Forms, Special Conditions/ Provisions, General Conditions, Supplemental General Conditions, the Drawings, Specifications, Acknowledgment of Owner, Acknowledgment of Contractor, Contractor's Certificate of Resolution, Performance and Payment Bonds, Prevailing Wage Rates, Bulletins, Notice of Award, Notice to Proceed, all Addenda issued prior to the execution of the Agreement and all Modifications thereafter. A Modification is a written amendment to the Agreement signed by the parties, a Change Order, written interpretations issued by the owner, or a written order for minor change in the Work issued by the owner. Whenever the word "Contract" and/ or "Contract Documents" are used herein it means all of the above documents or such part of them as is clearly indicated.

#### 1.1.3 PARTIES TO THE CONTRACT

- a. Contractor: As defined herein.
- b. Owner: New Jersey City University

#### 1.1.4 PARTIES NOT TO THE CONTRACT:

- a. Subcontractor: As defined herein.
- b. Construction/ Project Manager: As defined herein.
- c. Architect/ Engineer and/ or Consultants: As defined herein.

1.1.5 CONTRACT: The Contract includes the entire Agreement as defined in Paragraph 1.1.2 above between the parties hereto and supersedes any prior negotiations, representations or agreements. Nothing contained in the Contract Documents shall create any contractual relationship between the Contracting Officer and any Subcontractor or Material Supplier.

- 1.16            WORK: The Work comprises of all construction effort required by the Construction Documents and includes supervision, labor, coordination, material, inspection services, management, plant and equipment necessary to complete the construction.
- 1.1.7            PROJECT: The Project is a general term for identification of the total Contract. It includes the Work and all administrative aspects required to fully satisfy the Contract requirements.
- 1.1.8            UNIVERSITY: The word "University" or "Owner" as used herein means New Jersey City University.
- 1.1.9            CONTRACTING OFFICER: The "Contracting Officer" means the Contracting Officer of New Jersey City University or their duly authorized representative.
- 1.1.10           CONTRACTOR: A person, firm, or corporation with whom the contract is made by the Owner. Whenever the term "General Contractor" or "General Construction Contractor" is used herein, it means the Contractor. The word "Contractor", "Prime Contractor", "Prime", "Separate Contractor" or "Single Contractor", means the Individual, Partnership or Corporation undertaking to perform all or a part of the Work under the Contract, and includes Subcontractors, if any. It does not include suppliers or material firms, which do not provide "on-site" labor.
- 1.1.11           ARCHITECT/ ENGINEER: "Architect" or "Engineer" means the Architect or the Engineer (A/ E) engaged by the University to act as the authorized representative of the Contracting Officer to the extent described in Article 3 hereinafter.
- 1.1.12           SUBCONTRACTOR: The term "Subcontractor" means the person or persons, partnership, or corporation having a direct contract with a Contractor for the performance of Work under the Contract, or the subcontractors of any tier of such person, partnership or corporation. It is not one who furnishes materials, supplies or equipment without on-site labor.
- 1.1.13           APPROVAL OF WORK: Whenever the term "acceptable" or "approved" is used herein, it means written approval of the A/ E or the Owner.
- 1.1.14           CONTRACT LIMIT LINES: The term "Contract Limit Lines" refers to those lines shown on the Drawings which limit the boundaries of the Project and beyond which no construction Work or activities shall be performed by the Contractor unless otherwise noted on the Drawings or Specifications (i.e. utilities).
- 1.1.15           SITE: The term "Site", "Construction Site", or "Project Site" refers to the geographical area of the entire University campus, or a portion thereof,

or any other property at which the Work under the Contract is to be performed.

- 1.1.16 **NOTICE**: "Notice" is a written directive or communication served on the Contractor to act or perform Work or carry out some other contractual obligation. It shall be deemed to have been duly served if delivered to an individual or member of the firm or entity or to an officer of the corporation for whom it was intended. This includes delivery by fax, courier, registered or certified mail or telegram, to the business address cited in the Contract Documents.
- 1.1.17 **SHOWN**: Where the words "shown" or "shown on drawings" are used, they shall be construed to mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
- 1.1.18 **EQUAL**: Where the words "equal" or "equivalent" are used, each shall be construed to mean being same in value, measure, force, effect, significance, performance, quality. and corresponding in position and function, to that specified, subject to the approval of the A/ E and or owner.
- 1.1.19 **CONSTRUCTION / PROJECT MANAGER**: A person, firm or corporation engaged by the Owner, as a Consultant to monitor work in progress and perform specified duties.
- 1.1.20 **DIRECTED**: The terms "directed", "required", "permitted", "ordered", "designated", "prescribed" and words of like "importance" shall imply the direction, requirement, permission, order, designation or prescription of the A/ E and/ or the owner; "approved", "acceptance", "satisfactory", and words of like importance shall mean approved by, or acceptable or satisfactory to the A/ E and or the Owner "necessary", "reasonable", "proper", "correct" and words of like importance shall mean necessary, reasonable, proper or correct in the judgment of the A/ E and/ or the owner.
- 1.1.21 **PIPING**: "Piping" shall include in addition to pipe, all fittings, valves, hangers, and other accessories related to such piping.
- 1.1.22 **CONCEALED**: "Concealed" shall mean hidden from sight as in chases, furred spaces, shafts, hung ceiling, or embedded in construction.
- 1.1.23 **EXPOSED**: "Exposed" shall mean not "concealed", as defined above. Work in trenches, crawl spaces, and tunnels shall be considered "exposed" unless otherwise specifically noted.
- 1.1.24 **GOVERNMENTAL**: "Governmental" shall mean all municipal, state and federal governmental agencies having jurisdiction.

- 1.1.25 GENDER: SINGULAR NUMBERS:
- a. GENERAL: Unless the context otherwise connotes, as used in the Contract, words of one gender include the other genders; the singular includes the plural; the plural includes the singular.
  - b. MATERIALS, DEVICES, OR PARTS OF EQUIPMENT: Where referred to in the singular number, such references shall be deemed to mean as many such items as are required to complete the Work.
- 1.1.26 PROVIDE: Shall mean to furnish, erect, install and connect complete and ready for regular operation, the particular Work referred to, unless specifically indicated or specified otherwise.
- 1.1.27 FURNISH: Shall mean to supply and deliver to project site ready for unloading and installation (FOB jobsite).
- 1.1.28 INSTALL: Shall mean to erect, set in place, connect complete and ready for operation, the equipment furnished.

1.2 INTENT OF THE CONTRACT

- 1.2.1 The Drawings and Specifications of the Contract are intended to require the Contractor to provide for everything reasonably necessary to accomplish the proper and complete finishing of the Work. All Work and Materials included in the Specifications and not shown on the Drawings, or shown on the Drawings and not shown in the Specifications shall be performed or furnished by the Contractor as if described in both. Any incidental materials, and/ or Work not specified in the Drawings and/ or the Specifications which is, nevertheless, necessary for the true development thereof and reasonably inferable therefrom, the Contractor shall understand the same to be implied and required, and he shall perform all such Work and furnish all such materials as if particularly delineated or described therein. Should there be an obvious error or omission in the Drawings or Specifications, it shall be the Contractor's responsibility to complete the Work as reasonably required, consistent with the intent of such Drawings and Specifications as may be interpreted by the Contracting Officer.
- 1.2.2 The Contractor shall abide by and comply with the true intent and meaning of the Drawings, the Specifications and other Contractual Documents taken as a whole, and shall not avail himself of any unintentional error or omission, should any exist. Should any error, omission or discrepancy appear, or should any doubt exist, or any dispute arise as to the true intent and meaning of the Drawings, the Specifications or other Contract Documents, or should any portion

thereof be obscure, or capable of more than one interpretation, the Contractor shall immediately notify the Architect/ Engineer and seek correction or interpretation thereof prior to commencement of affected Work. The Architect/ Engineer shall issue his written Interpretation with reasonable promptness. However, the Contractor shall make no claim against the University for expenses incurred or damages unless, and only to the extent that the Contractor has submitted a written request for interpretation, clarification, or correction to the Architect/ Engineer and the Contracting Officer and such written request has been received by the Architect/ Engineer and the Contracting Officer at least five (5) Working days prior to the date fixed for the opening of bids, provided further that such claim shall only be recognized by the University if the University through the issuance of a Bulletin interprets, clarifies, and/ or corrects such error, discrepancy, omission, or conflict. In case of dispute, the matter shall be referred to the Contracting Officer for decision.

- 1.2.3 Each and every provision required by law to be inserted in the Contract Documents shall be deemed to have been inserted therein. If any such provisions has been omitted or has not been correctly inserted, then upon application of either party, the Contract shall be physically amended to provide for such insertion or correction.
- 1.2.4 The organization of the Specifications into Divisions, Sections and Articles, and the arrangement of Drawings shall not be construed by the Contractor as being intended to divide or allocate the Work among Subcontractors in any manner or to establish the extent of the Work to be performed by any trade.
- 1.2.5 Unless otherwise provided in the Contract Documents, the Contracting Officer will furnish to each Contractor, free of charge, two (2) copies of the Drawings and Specifications; and any additional instructions such as Supplemental Drawings; necessary for the proper execution of the Work. Additional sets will be provided at cost to the Contractor upon written request to the University.
- 1.2.6 The Contractor shall do no Work without proper Drawings and instructions unless authorization to proceed from the Contracting Officer is received by the Contractor, in writing. In giving such additional instructions, the Contracting Officer may make minor changes in the Work, not involving extra-cost.
- 1.2.7 All Drawings referred to, together with such supplementary details as may be furnished and approved from time to time by the A/ E as the Work progresses, are understood as being included as part of the Contract Specifications to which they relate.
- 1.2.8 The sequence of precedence of the contract documents is as follows:

- (1) Agreement
- (2) Instruction to Bidders
- (3) Special Conditions/ Provisions
- (4) Supplemental General Conditions
- (5) General Conditions
- (6) Supplemental General Conditions-Mechanical/ Electrical
- (7) Technical Specifications
- (8) Details
- (9) Drawings, in following order of precedence.
  - a) Notes on drawings
  - b) Large scale details
  - c) Figure dimensions

Where there may be a conflict in the Specifications or Drawings not resolvable by application of the provisions of this paragraph, then the greater quantity in labor, materials, or equipment shall be assumed to be required and shall be provided by the Contractor at no cost to the Owner.

1.2.9 On all Work involving alterations, remodeling, repairs or installation within existing buildings, it shall be the responsibility of the Contractor by personal inspection of the existing building, facility, plant or utility system, to satisfy himself as to the accuracy of any information given which may affect the quantity, size and/ or quality of materials required for a satisfactorily completed Contract, whether or not such information is indicated on the Drawings or included in the Specifications. All contractors shall include the cost of all material and labor required to complete the Work based on reasonably observable conditions.

1.2.10 The A/ E's drawings, constituting integral parts of this contract, serve as the bidding and the Working drawings. They indicate the arrangement of materials and completed physical spaces desired by the owner. These drawings may be augmented by revised detailed or supplementary drawings as specific explanations or modifications prepared by the A/ E and issued before normal sequence of construction require their use; the Contractor shall conform to all reasonable minor changes without extra cost to the owner. All drawings of all trades - general construction (referred to as "architectural"), structural, plumbing, HVAC and electrical - complement each other; no drawings are to be considered complete for any trade without all other drawings. The mechanical, electrical and fire protection drawings are diagrammatic only, and are not intended to show the alignment, physical locations or configurations of such Work. The Work shall be installed without additional costs to the Owner to clear all obstructions, permit proper clearances for the Work of other trades, satisfy all Code requirements and present an orderly appearance where exposed.

1.2.11 The technical specifications, constituting integral parts of this contract, serve as the bidding, purchasing and installation specifications. They

indicate the types and qualities of materials, equipments, etc., as well as quality of Workmanship.

- 1.2.12 All specifications are of the abbreviated type customary in the building, building materials and equipment supply industries, and as such they include incomplete sentences. Omissions of words and phrases such as "the contractor shall", in conformity herewith, "shall be", as noted on the drawings", according the plans, "a", "an", "the", and "all" are unintentional. Omitted words and phrases shall be supplied in inference in the same manner, as they are when a "note" occurs on the drawing.
- 1.2.13 The drawings and specifications, as a portion of the contract, are intended to provide for and comprise everything necessary for the proper and complete finishing of the Work in every part, notwithstanding that each and every item necessary may not be shown on the drawings or mentioned in the specifications. Drawings are intended to indicate locations, arrangements and assemblies of the parts of the system.
- 1.2.14 Specifications are intended to establish conditions of Work and quality of materials and Workmanship.
- 1.2.15 Where a discrepancy or inconsistency appears to exist between any of the contract documents regarding quantity or quality, or both, of labor and materials to be furnished for the Work, the greater quantity and the higher quality shall govern and will be presumed to be included in the bids.
- 1.2.16 Dimensions of the Work shall not be determined by scale or rule, and figured dimensions shall be followed at all times, unless obvious discrepancies exist. The Contractor shall verify all dimensions at the job site, and shall take any and all measurements necessary to verify the drawings and to properly lay out the Work. Any discrepancies affecting the layout of the Work shall be called to the Architect's attention. No Work so affected shall proceed until such discrepancy is corrected, and written confirmation of the resolution is provided by the Architect.
- 1.2.17 Where on any drawing a portion of the Work is fully drawn and the remainder is indicated in outline, the portions fully drawn shall apply to all other like positions of the Work, unless specifically indicated or specified otherwise.
- 1.2.18 All indications or notations which apply to one of a number of similar situations, materials or processes shall be deemed to apply to all such situations, materials or processes wherever they appear in the Work, except where a contrary result is clearly indicated by the Contract Document.

- 1.2.19 Where codes, standards, requirements and publications of public or private bodies are referred to in the Specifications, references shall be understood to be to the latest revision prior to the date of receiving bids, except where otherwise indicated. No provision in any publication including any standard shall change or affect the duties and responsibilities of the University, the architect or the Contractor. Nor shall they create an obligation on the part of the University or the architect to supervise or direct the Contractor's work.
- 1.2.20 Where no explicit quality or standards for materials or Workmanship are established for the Work, such Work is to be of good quality for the intended use and consistent with the quality of the surrounding Work and of the construction of the Project generally.
- 1.2.21 All manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the manufacturer's written or printed directions and instructions unless otherwise indicated in the Contract Documents.
- 1.2.22 Soil borings, test pits or other subsurface or site information regarding the physical site and subsurface conditions on or near the site may have been obtained from independent contractors for the purpose of preparing the design documents for the project rather than for the purpose of contractor estimating or bidding. Such information may be identified or included in the contract documents so that it can be reviewed by bidders during the bidding phase, but because of the limited nature and purpose of the information, it shall not be considered to be part of the contract documents, and the Contractor must assume responsibility for interpreting and relying upon the information.
- 1.2.23 The Contractor represents and warrants that before bidding it carefully studied all reports, surveys and documents included or identified in the bid documents regarding observations, inspections, investigations and tests of the site and subsurface conditions at or near to the site, and all information provided to bidders regarding physical conditions at or near the site, including surface and subsurface composition, water, structures and utilities, and that it determined that no further examinations, investigations, tests, studies or data were necessary for bidding or the performance of the contract work at the contract price. If the Contractor concluded that additional information is required, it must notify the University in writing at least 7 days before the bid due date.
- 1.2.24 The Contractor represents and warrants that before bidding it visited the site and familiarized itself with and was satisfied as to the general, local and site conditions which may affect the cost, progress and performance of the work and the contract, and that its bid and bid price take into account all such conditions.



1.2.25 The Contractor will not be responsible for hazardous environmental conditions uncovered or discovered on the site which were not disclosed in the contract documents. If such conditions are discovered, the Contractor shall stop work and notify the University in writing immediately. The University may issue a written directive to the Contractor requiring it to stop work until the hazardous environmental condition is remedied, and the Contractor will be entitled to an extension of the contract times if an extension is warranted under the provisions of the contract and the general conditions regarding extensions. The University may also make changes in the contract in response to the conditions, and the contract will be changed in accordance with the change order provisions in the contract and the general conditions.

1.2.26 The Contractor may not assert claims for extra compensation beyond the bid and contract price for constructing the completed project by reason of any errors, omissions, inconsistencies, or defects in the contract documents which are discoverable by a diligent and competent contractor, because of its obligation to review and study the bid documents before submitting its bid, and because of its obligation to notify the University in writing before submitting its bid of errors, omissions, inconsistencies, and defects in the documents. This limitation on claims may be modified and further restricted in the signed contract when the contract requires the Contractor to participate in any aspect of the design phase.

The Contractor may assert claims for extensions and additional compensation in accordance with the contract and general conditions if information regarding the site which is identified in the bid or contract documents is factually inaccurate, and the inaccuracy is one, which a reasonably competent and diligent contractor would not discover in preparing a bid. The Contractor may not assert a claim for an extension or extra compensation when it claims, not that the information is factually inaccurate, but rather that conclusions, inferences or judgments made in reliance on accurate information prove to be incorrect.

1.3 Conformity of Work to Contract Documents.

1.3.1 All work performed shall conform to the lines, grades, cross-sections, dimensions, material requirements, tolerances, details and other information in the contract documents. The purpose of tolerances is to accommodate occasional minor variations from the middle portion of the tolerance range, which are unavoidable despite reasonable construction practices. When a maximum or minimum tolerance value is specified, the material and the work shall be controlled so that they shall not be preponderantly of borderline quality or dimension.

END OF ARTICLE 1

## ARTICLE 2

### CONTRACTING OFFICER

#### 2.1 DEFINITION

- 2.1.1 The Contracting Officer of the University is charged with administering the design, engineering and construction of all University facilities. He and/ or his authorized representative, represents the University in all relationships with Contractors Architects and Engineers. Whenever the term Contracting Officer is used within the Contract Documents it shall be understood to mean the Contracting Officer or his authorized representative as he may direct.

#### 2.2 THE CONTRACTING OFFICER'S STATUS

- 2.2.1 The Contracting Officer maintains general administration and directs the Work. He shall exercise the duties and responsibilities consistent with the limitations of his statutory authority and as set forth in the Contract Documents. He will not be responsible for, nor will he have control or charge of construction means, methods, techniques or safety of the project or programs associated therewith.
- 2.2.2 The Contracting Officer shall furnish all available surveys defining the physical characteristics, legal limitations and utility locations of the project, as well as description of the site. The University assumes no liability for the accuracy or completeness of these surveys.
- 2.2.3 The Contracting Officer is the interpreter of the Conditions of the Contract and the judge of its performance. He shall not take arbitrary positions benefiting either the University or the Contractor, but shall use his powers under the Contract to enforce its faithful performance by both.

#### 2.3 CONTRACTING OFFICER'S RIGHT TO STOP THE WORK

- 2.3.1 If the Contractor fails to correct defective Work, or persistently fails to carry out the Work in accordance with the Contract Documents, the Contracting Officer may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated. Stoppage of the Work of any Contractor, however, shall not render the University liable for claims of any kind, including delays sustained by a Contractor as the result of the stoppage of the Work.

#### 2.4 CONTRACTING OFFICER'S RIGHT TO TERMINATE FOR CAUSE

- 2.4.1 If the Contractor makes a general assignment for the benefit of their creditors, or if a receiver is appointed on account of their insolvency, or if they persistently or repeatedly refuse or fail, except in cases for which extension of time is provided, to supply enough properly skilled Workmen or proper materials so as to avoid or eliminate delays in the orderly progress of the Work in accordance with the approved schedule, or if they fail to make prompt payment to Subcontractors or for materials or labor, or persistently disregard laws, ordinances, rules, regulations or orders of any public authority having jurisdiction, or if they, or any of their Subcontractors, are guilty of a substantial violation of a provision of the Contract Documents, or otherwise default or neglect to carry out the Work in accordance with the Contract Documents, then the Contracting Officer may, without prejudice to any right or remedy, and after giving the Contractor and his Surety three (3) Working days written notice to forthwith commence and continue correction of such default or neglect with diligence and promptness, terminate the employment of the Contractor by the issuance of a written notice to that effect to the Contractor and their Surety, at any time subsequent to three (3) Working days thereafter, should they, or either of them, fail to comply with the demands of the original three (3) day notice, above mentioned.
- 2.4.2 Upon such termination the Contracting Officer may take possession of the site and of all the materials, equipment, and tools on the site, and may finish the Work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. The person or firm designated to carry out such Work will be paid as authorized by the Contracting Officer, without entailing any personal liability upon the officers of the University issuing certificates or making such payments.
- 2.4.3 If the unpaid balance of the Contract Sum exceeds the cost of finishing the Work, including Liquidated Damages for delays, and all consequential damages sustained by the University flowing from such breach of Contract, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor and/or his Surety shall pay the difference to the University. This obligation shall survive the termination of the Contract.
- 2.4.4 If within three (3) Working days following receipt of Notice of Termination by the Contractor's Surety, the issuer of the Performance and Payment Bonds, the said Surety exercises its right to take over the Work and expeditiously commences to prosecute the same to completion, the Contracting Officer shall permit him to do so under the following terms and conditions:
- a. Evidence of the Surety's intention to take over and complete the Contract shall be in writing over the signature of an authorized

representative and served upon the Contracting Officer within three (3) days after receipt by the Surety of Notice of Termination.

- b. The execution of a written Agreement between the University, by the Contracting Officer, and the Surety whereby the latter undertakes and assumes the obligation to complete the balance of the Work of its defaulting Contractor. In such case the Work must be performed by a Contractor satisfactory to the Contracting Officer and at the Surety's sole cost and expense. The disposition of unpaid contract balances, if any, then in the possession of the University may be stipulated within said agreement.
- c. The said Agreement shall also expressly provide that the Surety shall not be relieved thereby from any of its obligations under the Performance and Payments Bonds and that new Payment and Performance Bonds will be provided to secure the faithful performance of the Substituted Contractor, further:

That all current obligations for labor and materials incurred and outstanding by the defaulting Contractor on this Project be paid without delay, subject to allowance of a reasonable time within which to verify such claims by the Surety; and,

That the parties expressly understand and agree that this Agreement is without prejudice and is subject to such rights and remedies as either party (including the Contractor) may elect to assert after final completion and acceptance of the Work.

## 2.5. CONTRACTING OFFICERS RIGHT TO TERMINATE FOR CONVENIENCE

- 2.5.1 The Contracting Officer reserves the right to terminate for the convenience of the University in which case the Contractor shall be entitled to a proportion of the fee which the services were actually and satisfactorily performed shall bear to the total services contemplated under this agreement, less payments previously made, and a reasonable termination fee to be negotiated between the Contractor and the Contracting Officer.

## 2.6 REVIEW OF CONTRACTOR CLAIMS AND DISPUTES

2.6.1

Upon presentation by the Contractor, of a request in writing, the Contracting Officer may review any decision or determination of the A/ E, University's representative and/ or its other consultants, if any, as to any claim, dispute or any other matter or question relating to the execution or progress of the Work or the interpretation of the Contract documents. Consistent with the intent of the Contract, the Contracting Officer may schedule a conference for the purpose of resolving such claims, disputes, or other matters. Where such a conference is conducted, the Contractor shall be afforded the opportunity to be heard on the matter in question. Following review of the Contractor's request, the University and the Contractor may resolve the disputed matter, provided, however, that any such resolution shall be subject to all requirements imposed by law, including where applicable, the New Jersey Contractual Liability Act. N.J.S.A. 59:13-1 et. seq.

END OF ARTICLE 2

## ARTICLE 3

### ARCHITECT ENGINEER/ CONSTRUCTION MANAGER/ OWNER'S REPRESENTATIVE

#### 3.1 GENERAL

3.1.1 The A/ E is the person or persons lawfully licensed within the State of New Jersey to practice architecture or engineering. The A/ E is responsible for the design of this project and for certain project administration as identified in the Contract Documents. The term A/ E means the A/ E or their authorized representatives.

3.1.2 When the University provides full supervision and management of a project; the A/ E's role is that of consultant to the University.

3.1.3 The Construction Manager(CM), when employed by the University, will in collaboration with the A/ E, provide general administration of the Contract.

#### 3.2 ADMINISTRATION OF THE CONTRACT

3.2.1 The administration of the Contract may be accomplished in any of the following matters:

- a. The University may assume full supervision and responsibility by in-house personnel.
- b. The A/ E may be assigned the "normal role" of administration with duties and responsibilities basically as described hereafter. In this instance the University will provide its own site/ administration and will retain final approval of all matters.
- c. The University may employ a Construction Manager (CM). The relationship of the University, the A/ E and the CM will be fully explained to the bidders prior to the receipt of bids.

#### 3.3 STATUS OF OWNER'S REPRESENTATIVE

3.3.1 The Contracting Officer hereby designates the Director for Campus Planning and Development to represent him in technical and administrative negotiations with any and all Contractors. He shall have the authority to stop any Contractor's work whenever such stoppage may reasonably be necessary to insure the proper execution of the Work. The stoppage of the Work shall not render the Owner liable for claims of any kind, including, without limitations, claims for money damages, either by the affected contractor, or by any other contractor.

3.3.2 The Owner will assign its own technical representatives to duty at the site to conduct on-site observations of the Work in progress as the basis for determining the progress and performance of the Work, materials and equipments. These representatives will also receive and maintain custody of samples, guarantees, and manuals furnished by the Contractor; assist in reviewing Contractor's requisitions for payment and in providing liaison between the Contractor and the A/ E. The Contractor will assist the Owners representatives in implementing procedures to monitor scheduling, coordination, cost accounting, quality control and safety programs. The presence of and/ or observations of these personnel shall not relieve the Contractor or the A/ E, of any of their respective responsibilities under the contract.

3.4 ARCHITECT'S STATUS

3.4.1. The A/ E will: provide general administration, including performance of the functions hereinafter described; issue written interpretations necessary for the proper execution and progress of the Work in the forms of drawings or otherwise. Such interpretations will be consistent with and reasonably inferable from the Contract Documents; and be the interpreter of the requirements of the Contract Documents, and shall within seven (7) days render such interpretations deemed necessary for the proper execution and progress of the Work; and monitor the progress and quality of the Work and determine if the Work is proceeding in accordance with Contract Documents; and keep the Owner informed of the progress of the Work; and endeavor to guard the Owner against defects and deficiencies in the work of the Contractor; and condemn Work as failing to conform to the Contract Documents; and have authority to order minor changes in the Work not involving an adjustment to the Contract price or an extension of the contract time and not inconsistent with the intent of the Contract documents; and review, edit as appropriate and approve monthly payments to the Contractor; and solicit information from the Contractor, and prepare recommendations and documents for Change Orders; and review Shop Drawings; receive written guarantees and related documents as required by the Contract and assembled by the Contractor and issue to the Owner a recommendation for approval of final certificate of payment.

3.4.2. All questions pertaining to the Contract Documents, Work, samples or materials requiring approval, decisions, or interpretations of the specifications and the drawings, shall be made to the A/ E sufficiently in advance of fabrication or construction to permit comparison, investigation, reference to drawings and specifications, details or shop drawings, and consultation as necessary and desirable.

3.4.3. The A/ E and/ or the CM will not be responsible for, nor will they have control or charge of construction means, methods, techniques, sequences of procedures, or safety precautions and programs in connection with the



Work. They will not be responsible for, nor have control or charge over, the acts or omissions of the Contractor, Subcontractors, or any of their agents or employees, or any other person performing any of the Work, but shall have the obligation to immediately inform the Contracting Officer of any inadequate performance on the project.

- 3.4.4 The A/ E and/ or the CM shall reject Work, which does not conform to the Contract Documents. Whenever, in their opinion, they consider it necessary or advisable, they may request the Contracting Officer to provide special inspection or testing of the Work, whether or not such Work has been fabricated, installed or completed.
- 3.4.5 The A/ E and/ or the CM will inspect periodically the Contractor's as-built drawings to insure that these are up-to-date and shall review the completed as-built plans at project completion to ensure that they are complete and are provided to the University.
- 3.4.6 The A/ E will conduct inspections to determine the dates of substantial and final completion and to determine if the Contractor has properly substantially and finally completed the project. The architect will obtain all written warranties and all other documents, which the Contractor is required to provide at the time of the project completion. The architect will make a recommendation to the University regarding final project and final contract acceptance.
- 3.4.7 All Drawings, Specifications and copies thereof furnished by the A/ E are and shall remain the property of the University. They are reserved to this Project only and are not to be used on any other Projects. Submission or distribution of Documents to meet official regulatory requirements, or for any other purposes in connection with the Project shall not be construed as derogation of the A/ E's copyright or other reserved rights.

3.5 ACCESS TO WORK SITE

- 3.5.1 The Owner, the A/ E, the CM and their representatives shall at all times have access to the Work Site. The Contractor and subcontractors shall provide all reasonable facilities, labor, materials, equipment and assistance for the safe and convenient conduct of such access.

END OF ARTICLE 3

## ARTICLE 4

### THE CONTRACTOR

#### 4.1 DEFINITION

- 4.1.1 The Contractor, as the term is used throughout these documents, means the firm or individual responsible for performing the Work under the Contract, whether it be referred to as "Contractor", "General Contractor", "Separate Contractor", or "Single Contractor". It does not include suppliers or material person.

#### 4.2 REVIEW OF CONTRACT

- 4.2.1 The Contractor has the duty and warrants and represents that he has thoroughly examined and is familiar with all the Contract Documents, including but not limited to, the complete set of Drawings and Specifications of the entire project; that he has carefully examined the site for access and limitations, if any, and has satisfied himself as to the nature and location of the Work, the current local equipment labor and material conditions, and all matters which may in any way affect the Work or its performance. As a result of such examination and investigation, the Contractor warrants and represents that he fully understands the intent and purposes of the Contract Documents and their obligations there under and that he accepts responsibility for, and is prepared to execute and fulfill completely, by their construction Work, the intent of the Contract, without exception and without reservation, at the price specified in the Contract.
- 4.2.2 The Contractor shall carefully study and compare the Contract Documents during the progress of the Work and shall immediately report any error, inconsistency, ambiguity or omission to the University upon discovery and shall do no Work thereafter which may be affected by such error until the University has had the opportunity to respond and clarify the Work it wants performed in view of this information. Wherever any error, inconsistency or omission appears, it shall be disposed of pursuant to appropriate procedures set forth elsewhere herein.
- 4.2.3 Unless otherwise ordered in writing by the Contracting Officer, the Contractor shall perform no portion of the Work without approved Shop Drawings or Samples for such portions of the Work, or other approvals as may be applicable and required by the Contract Documents.
- 4.2.4 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for all labor, equipment, material, tools, construction equipment and machinery, water, heat utilities, transportation and other facilities and services necessary for the proper

execution and completion of the Work, whether or not incorporated or to be incorporated in the Work.

4.2.5 The Contractor shall at all times enforce strict discipline and good order among their employees and shall not employ on the Work any unfit person or anyone not skilled in the task assigned him. The Contractor shall provide the University with safety programs to be implemented during the course of this project.

4.2.6 The Contractor shall be obligated to pay the prevailing wage rates, abide by the requirements of the State's Affirmative Action Program, and be responsible to insure that all principles of Safety are carried out as further described in Article 12 herein.

4.3 NEW JERSEY PREVAILING WAGE ACT

4.3.1 The Contractor and each Subcontractor shall comply with the New Jersey Prevailing Wage Act Laws of 1963, Chapter 150, and all amendments thereto and this Act is hereby made a part of every Contract entered into on behalf of the University except those contracts which are not within the contemplation of the Act. Provisions of the Act include:

- a. All Workmen employed in the performances of every Contract in which the Contract Sum is in excess of the amount designated by the State of New Jersey shall be paid not less than the Prevailing Wage Rate as designated by the Commissioner of Labor and Industry.
  - (1) The Contractor and Subcontractor performing Work for the University shall post the Prevailing Wage Rates for each craft and classification involved, including the effective date of any changes thereof, in prominent accessible places at the site of the Work or at such place or places as are used by them to pay Workmen their wages.
  - (2) The Contractor's signature on their proposal is their guarantee that neither he nor any Subcontractor is currently listed, or on record by the Commissioner, as one who has failed to pay Wages according to the Prevailing Wage Act.
- b. In the event it is found that any Workman, employed by any Contractor or any Subcontractor, has been paid wages less than the Prevailing Wage; the Contracting Officer may terminate the Contractor's or Subcontractor's right to proceed with the Work, or such part of the Work as to which there has been a failure to pay required wages and may otherwise prosecute the Work to completion.

c. Nothing contained in the Prevailing Wage Act shall prohibit the payment of more than the prevailing wage rate to any Workman.

4.3.2 The Contractor shall submit, to the Owner, certified payrolls for their firm and all subcontractors, within ten (10) days of the payment of wages. (NJAC 12:60-2.1; NJAC 34:11-56.25)

4.4 SUPERVISION AND CONSTRUCTION PROCEDURE

4.4.1 The Contractor shall supervise and direct the Work using their best skill and attention. The Contractor shall be solely responsible for all construction means, methods, techniques, sequences, safety requirements as required by Federal and/ or State Agencies and procedures for coordinating all portions of the Work under the Contract.

4.4.2 The Contractor shall employ a full-time competent Superintendent, acceptable to the University, who is capable of communicating with the workforce and University officials. The Superintendent shall be in attendance full - time on the Project site during the progress of the Work. Communications given to the Superintendent shall be as binding as if given to the Contractor. Important communications shall be confirmed in writing. The University reserves the right to require a change in a Superintendent if his/ her performance, as judged by the Contracting Officer, is deemed to be inadequate. Upon application, in writing to the Contracting Officer, this requirement for full-time Superintendent may be waived should he determine that such staffing is not required by the University.

4.4.3 The Contractor shall employ qualified competent craftsmen in their respective lines of Work.

4.4.4 The various Subcontractors shall likewise have competent Superintendents and/ or Foremen in charge of their respective portions of the Work at all times. They shall not employ a person unfit or unskilled in the Work assigned to him. If it should become apparent that a Subcontractor does not have their portion of the Work under control of a competent Foreman, the Contractor shall have the obligation to take appropriate steps to immediately provide proper supervision.

4.4.5 If, due to a trade agreement, standby personnel are required to supervise equipment installation, or for any other purpose, the Contractor will provide such standby services. These said services are to be provided at no additional charge.

4.5 RESPONSIBILITY FOR THE WORK

- 4.5.1 The Contractor shall be responsible to the Contracting Officer for the acts and omissions of their employees, subcontractors and their agents and employees, which injure, damage or delay the University's employees, properties, consultants, agents or other Contractors in the performance of their Work. This responsibility is not limited by the applicable provisions stated elsewhere herein, but is in conjunction with, and related thereto.
- 4.5.2 The Contractor shall be responsible for all damage or destruction caused directly or indirectly by their operations to all parts of the Work, both temporary and permanent, and to all adjoining properties by reason of the neglect in providing proper lights, guards, barriers or any other safeguards to prevent damage to property, life, and limb.
- 4.5.3 The Contractor shall, at their own expense, protect all finished Work liable to damage and keep the same protected until the Project is completed and accepted. In the case of Substantial Completion, accompanied by Beneficial Occupancy by the University, the Contractor's obligation to protect their finished Work shall cease simultaneously with the occupancy of the portion or portions of the structure. Each Contractor is responsible for the protection of structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- 4.5.4 The Contractor shall defend, protect, indemnify and hold harmless the University, the Architect/ Engineer, and CM from all claims, suits, actions, damages and costs of every type and description arising out of, or resulting from, the performance of their Work under this Contract. This responsibility is not limited by the provisions of other indemnification provisions included elsewhere herein.

4.6 CODES, LICENSES, PERMITS and INSPECTIONS

4.6.1 APPLICABLE CODES

- a. The Plans and Specifications are intended to conform with the 2003 New Jersey Building Code including the following:
  - 1. International Building Code 2000, New Jersey edition.
  - 2. The National Standard Plumbing Code
  - 3. The National Electrical Code
  - 4. International Energy Conservation Code 2000
  - 5. International Fire Code 2000
  - 6. International Mechanical Code 2000
  - 7. International Plumbing Code
- b. The applicable provisions of the National Fire Codes, as published by the National Fire Protection Association also applies.
- c. The Contractor is responsible to insure the construction is in accordance with the New Jersey Uniform Construction Code as defined above.
- d. If the Contractor ascertains at any time that any requirement of the Contract is at variance with the applicable State or Federal laws, regulations or building code requirements, the Contractor shall promptly notify the Owner, and any necessary adjustments of the Contract shall be made as provided for under “Changes of Work”.

4.6.2 INSPECTION, LICENSES AND PERMITS

- a. Local municipalities are not required to inspect the Work, however, the Contractor shall obtain any special type permits and/ or inspections required, such as: boilers, incinerators, nuclear facilities or with municipal or public utilities, streets, sidewalks, etc. The obtaining of a Building Permit and the inspections relative to the New Jersey Uniform Construction Code are responsibilities of the Owner. However, the Contractor shall fill out the New Jersey Uniform Construction Code forms, as applicable and submit to the Owner. It is the Contractor’s responsibility to contact the Owner’s Construction Official, a minimum of seventy-two (72) hours in advance of required inspection. Inspections may be performed by a third party agency hired by the Owner. Should the Contractor schedule an inspection and not be prepared at the time the Inspector arrives, the Contractor will be responsible for any costs of time and travel resulting from having the Inspector return to the job site for re-inspection. This pertains to routine, as well as final certification of occupancy inspections.

- b. Soil conservation measures are to be in accordance with the Soil Conservation District requirements.
- c. All sewage disposal Work shall conform with the regulations of the State Department of Environmental Protection.
- d. The University at contract award, upon Contractor's request, will name inspector/ inspection agency responsible for code enforcement. A Certificate of Code Compliance is to be obtained from the appropriate inspector prior to the issuance of the Certificate of Final Acceptance for the Work.
- e. Prior to the start of any crane equipment operations, each Contractor shall make all necessary applications and obtain all required permits from the Federal Aviation Administration (F.A.A.).
- f. Consistent with Subparagraph 4.5.4, each Contractor shall be responsible for and hold harmless the University, Architect/ Engineer, and CM from all fines, penalties or loss incurred for, or by reason of, the violation of any municipal ordinance or regulation or law of the State while the said Work is in process of construction.
- g. As a result of a finding, by an appropriate Finder of Fact, that a Contractor caused a substantial violation of a State, Local or Federal statute or regulation on said project, the University may declare the Contractor to be in default.

4.7 STORAGE, CLEANING AND FINAL CLEAN UP

- 4.7.1 The Contractor shall confine his apparatus, the storage of his equipment, tools and materials, and operations and Workmen to areas permitted by law, ordinances, permits, contract limit lines as established in the Contract Documents, the rules and regulations of the University, or as ordered by the Contracting Officer, and shall not unreasonably encumber the site or the premises with his materials, tools and equipment.
- 4.7.2 The Contractor shall at all times during the Progress of the Work keep the premises and the job site free from the accumulation of all refuse, rubbish, scrap materials and debris caused by their operations, to the end that at all times the premises and site shall present a neat, orderly and Workmanlike appearance. This is to be accomplished as frequently as is necessary by the removal of such material, debris, etc. from the site and the Owner's premises. Loading, cartage, hauling and dumping will be at the Contractor's expense. "General Construction Contractor shall provide and maintain 'chutes' to contain all rubbish discarded from building openings above the first floor".

- 4.7.3 At the completion of the Work, each Contractor shall remove all their tools, construction equipment, machinery, temporary staging, false-work, form-work, shoring, bracing, protective enclosures, scaffolding, stairs, chutes, ramps, runways, hoisting equipment, elevators, derricks, cranes, etc. from the Project Site.
- 4.7.4 Project cleanliness is of the utmost importance. The University reserves the right to withhold monthly progress payments from the Contractor for failure to properly perform clean-up obligations until such obligations have been satisfied. Should the Contractor not promptly and properly discharge their obligation relating to Cleaning and Final Clean Up, the University shall have the right to employ others and to charge the cost thereof to the Contractor(s) deemed by the Contracting Officer to be responsible therefore, after first having given the Contractor a three (3) Working day written notice of such intent.
- 4.7.5 The Contractor's responsibilities, in final clean up, include the following:
- a. Remove all debris and rubbish resulting from or relating to the Work. (Separate primes, if involved, are required to remove their own debris, etc., in accordance with other provisions with this Contract.
  - b. Remove all stains from glass and mirrors and wash and polish all windows, doors etc., inside and outside.
  - c. Remove marks, stains, fingerprints, other soil, dust or dirt from painted, decorated or stained woodwork, plaster or plasterboard, metal, acoustic tile and equipment surfaces.
  - d. Remove spots, paint and soil from resilient, glaze and unglazed masonry and ceramic flooring and wall Work.
  - e. Remove temporary floor protections, clean, wash or otherwise treat and/ or polish, as directed, all finished floors.
  - f. Clean exterior and interior metal surfaces, including doors and window frames and hardware, of oil stains, dust, dirt, paint and the like; polish where applicable and leave without fingerprints or blemishes.
  - g. Restore all landscaping, roadway and walkways to pre-existing condition. Damage to trees and plantings shall be repaired in the next planting season, and such shall be guaranteed for one year from date of repair and/ or replanting.



4.7.6 All construction equipment, materials or supplies of any kind, character or description of value belonging to the Contractor, which remain on the job site for more than thirty (30) days from the date of the Certificate of Final Acceptance, shall become the absolute property of the University. It will be disposed of in any manner the University shall deem reasonable and proper and all costs relating thereto shall be the responsibility of the Contractor.

4.8 CUT-OVERS, INTERRUPTIONS TO EXISTING BUILDINGS

4.8.1 Except as otherwise expressly provided in the Contract Documents, the Contractor shall be responsible for submitting to the Owner, for approval, a proposed schedule of all utility shutdowns and Cut-Overs of all types which will be required to complete the Project; said schedule should contain a minimum of two (2) week's advance notice prior to the time of the proposed shutdown and Cut Over. The University campus is in full operation 12 months of the year, and shutdowns and Cut-Overs, depending upon their type, generally must be scheduled on weekends, nights or during holiday periods. The contract is deemed to include all costs, necessary overtime, and all premium time, if any, that is required by the Contractor to complete the shutdowns or Cut-Overs.

4.8.2 Temporary Connections – In the event the Contractor shall disrupt any existing services, the Contractor shall immediately make temporary connection(s), provisions, etc., necessary to restore the disrupted service. The temporary connection(s), provisions, shall remain in operation until the existing service has been permanently restored. All costs for such work shall be at the sole expense of the Contractor.

4.9 NON-REGULAR WORKDAYS

4.9.1 Regular working hours shall be in accordance with local trade labor agreements, Monday through Friday. If a conflict exists between the Trades, the Contractor(s) shall resolve the matters at their own expense. The University will not pay for “standby Labor” or any other costs generated by any such conflict. Changes thereto may be granted with written approval of the Contracting Officer. Any Work to be performed after regular working hours or on Saturdays, Sundays, or Legal Holidays as may be reasonably required consistent with contractual obligations, shall be performed without additional expense to the University. The Contractor shall obtain approval from the Contracting Officer for performance of Work after regular working hours or on non-regular workdays at least 24 hours prior to commencement, unless such Work is caused by emergency.

4.10 DRAWINGS, SPECIFICATIONS, SHOP DRAWINGS, AS-BUILT DRAWINGS

- 4.10.1 The A/ E will furnish response to request for information (RFI), after being made aware of its need by the Contractor and additional Instructions for the proper execution of the Work. All such Drawings and Instructions shall be consistent with the Contract Documents and reasonably inferable there from and the Work shall be executed in conformity therewith. The Contractor shall do no Work without proper Drawings and Instructions. In giving such Instructions, the Contractor will have to make minor changes in the Work, not involving extra cost.
- 4.10.2 Where certain portion of the Work is shown in complete detail, but not repeated in similar detail in other areas on the Drawings, or there is an indication of continuation, the remainder being only shown in outline, the Work shown in detail shall be understood to be required in other like portions of the project.
- 4.10.3 The Contractor shall not make any claims whatsoever based upon insufficient data or their incorrectly assumed conditions, nor shall he claim any misunderstandings with regard to the nature, conditions or character of the Work to be done under the Contract and he shall assume all risks resulting from any changes in conditions, not caused by the University or its agents, which may occur during the progress of the Work.
- 4.10.4 Within two (2) weeks of contract award, the Contractor shall submit to the Owner a submission schedule for all required product data, shop drawings, samples, certificates, calculations, etc., indicating the submittal description, submittal type, and date of submission to the A/ E for review and approval.
- 4.10.5 This step-by-step procedure shall be followed in the development and submittal of the “Shop Drawings, Samples, Product Data, and Certificates”:
- A. Definitions:
1. Definition: Shop Drawings - drawings, diagrams, illustrations, schedules, test data, performance charts, cuts, brochures and other data specifically prepared for the Work, to illustrate some portion of the Work.
  2. Product Data - product literature brochures, performance charts, diagrams, and other information to describe a material, product or system for some portion of the Work.
  3. Samples - physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work is to be completed.

4. Mock-ups - full-scale sections of portions of the Work, which demonstrate materials and workmanship and establish standards by which the Work is to be completed.
5. Notarized Certificates are certificates of compliance furnished by the Contractor to verify that the material scheduled conforms to the standard schedule.

B. Contractor Responsibility:

1. The Contractor shall review, approve and submit all Shop Drawings, Product Data, Samples, Certificates or any other submission material in such sequence as not to cause any delay in the Work or any delay to separate contractors. The Contractor shall coordinate each Shop Drawing and Sample with requirements of the Contract and shall determine whether or not such Shop Drawings are in conformity with the provisions of the Contract before submitting the Shop Drawings for Approval.
2. The Contractor shall verify all field measurements. Measurements available prior to submittal of Shop Drawings shall be shown and so noted on the Shop Drawings. Measurements not available prior to submission of Shop Drawings as not available and such measurements shall be obtained prior to fabrication.
3. The Architect's approval of submittals shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract. The Contractor shall be responsible for the accuracy and conformity of the submittals with the Contract unless the Contractor has notified the Architect in writing, at the time of submission, and has received from the Architect written approval of the specified deviations. The Architect's approval shall not relieve the Contractor of responsibility for errors or omissions in the submittals.

C. Contractor Review:

1. The Contractor shall review all subcontractor submittals prior to submission to the Architect for conformity.
2. By approving subcontractor submittals prior to submission to the Architect, the Contractor represents; that he has determined and verified materials, quantities, dimensions,

specified performance criteria, catalog numbers, field measurements, field construction criteria, installation requirements.

3. Data shown on submittals shall be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to permit the Owner's Representative and Architect to review the information.
  4. At the time of each submission, the Contractor shall give the A/ E specific written notice of each variation that the submittal may have from the Contract Documents.
  5. The Contractor shall note on resubmissions, revisions other than the revisions or corrections on previous submittals.
  6. Submittals which do not conform to the requirements stated in the Contract Documents will be considered unacceptable, unless otherwise determined acceptable under the provisions of this Section.
  7. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility for executing the Work in accordance with the requirements contained in the Contract Documents, even though submittals have been reviewed and approved, or accepted.
- D. Shop Drawings shall show the design, dimensions, connections and other details necessary to ensure that the Shop Drawings accurately interpret the Contract Documents and shall also show adjoining work in each Detail as required to provide proper connections with said adjoining Work. Where adjoining connected Work required Shop Drawings, such Shop Drawings shall be submitted to the Owner or the Owner's Representative for approval at the same time so that connections can be checked. The Contractor shall verify all field measurements.
- E. Submittals shall be checked and signed by the Contractor, prior to submission to indicate that the Contractor has coordinated the Work and that it conforms to the Contract Documents.
- f. Calculations required to be submitted shall be prepared and certified by a Professional Engineer registered in the State of New Jersey and shall convey, or be accompanied by sufficient information to completely explain the structure, machine or system described, and in its intended manner of use.

G. Each submission shall be labeled with the following information:

1. Project title.
2. Contract name.
3. Date of submission, including dates of any revisions.
4. Name of Contractor, name of subcontractor, material supplier and manufacturer, as applicable.
5. Name of person or firm preparing submission.
6. Contract drawing numbers and specification section, division and paragraph numbers used as references in preparing submission.
7. Space for review stamp by Architect or Engineer.
8. The Contractor shall prepare and process a submittal, with reasonable promptness and in orderly sequence so as to cause no delay in the Work or in the work of the Owner or any separate contractor, submittals required by the Contract Documents or subsequently by the Owner's Representative, Architect or the Owner, to more fully explain or illustrate some portion of the Work. Sequence submission of shop drawings, product data, samples, etc., such that all information is available for reviewing each submittal when it is received. Partial or piecemeal submittals are not acceptable and will be returned without action.
9. The Contractor shall not make submittals which are incomplete or which do not comply with the Contract Documents.
10. The Contractor shall coordinate and effectively sequence different categories of submittals for the same work and for interfacing units of the Work, so that one will not be delayed for lack of coordination with another.
11. Submittals shall indicate compliance with called-for standards and codes, and identify materials. Coordination details shall be clearly noted. Include complete information from making necessary connections with related and adjoining Work.

H. Shop Drawing Requirements are as follows:

1. Provide shop drawings with graphic data accurately scaled and dimensioned. List reference Contract Drawing numbers and shop drawing numbers for related work by subcontractors, material men, sub-subcontractors, and fabricators.
2. Symbols and numbers used on the Contract Drawings and in the Schedules shall be used on shop drawings or shall be shown in parenthesis. Items shown on shop drawings shall be clearly identified with their location in the Work, or by sheet or detail number in which they appear.
3. Contract Drawings shall not be reproduced or used for shop drawings or erection purposes without prior written approval.
4. Number shop drawings consecutively. Shop drawings shall be of uniform size, form, and title as the Construction Manager may require.
5. Drawings, the original design for which is the responsibility of the Contractor, shall bear the seal of a Professional Engineer registered in the State of New Jersey.
6. Shop drawings shall show design, dimensions, and kinds of materials, connections, and other details necessary to ensure that requirements appearing in the Contract Documents are accurately interpreted. Shop drawings shall show proper connections with adjoining work in detail. Where adjoining work requires shop drawings, such drawings shall be submitted for review at the same time so that connections can be accurately checked.
7. Shop drawings shall: (i) establish the actual detail of manufactured or fabricated items and indicate proper relation to adjoining work; (ii) incorporate minor changes of design or construction details to suit actual conditions; and (iii) supplement the Contract Documents by the correctly reflecting field conditions and incorporating required field measurements. Identify and verify where field dimensions are required and obtain required field dimensions.
8. Where separate Sections are involved, shop drawings shall be coordinated and where required by the Owner's Representative or Architect shall be submitted in composite form clearly designating Section, subcontractor,

or trade, and compliance responsibility. The words “work by others” will not be accepted.

- I. Samples shall be of sufficient size and number to show the quality, type, color, finish and texture of the material required to be furnished by the Contractor pursuant to the Contractor or as noted in the specifications.
- J. The Contractor shall refer to individual sections of the specifications for requirements concerning field mock-ups of samples. The Contractor shall be responsible to locate mock-ups of samples. The Contractor shall be responsible to locate mock-ups where directed by the Architect, and to protect, maintain, remove and dispose of the mock-ups as directed by the Owner’s Representative.
- K. The Contractor shall keep at the site an up-to-date approved set of shop drawings, product data, samples and certificates for review by the Owner and Architect.

L. REVIEW

Owner’s Representative and the Architect will review submittals with reasonable promptness not more than fourteen (14) days after receipt. Review will be only for conformance with the design concept of the Project and with the information given in the Contract Documents and will not extend to means, methods, techniques, sequences or procedures of construction (except where specific means, methods, techniques, sequences or procedures of construction are required by the Contract Documents). The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions. The Contractor shall make corrections required and shall return the required number of corrected copies of shop drawings and submit as required new product data and samples for review and approval.

Following review, the Architect will note one (1) of five (5) actions:

- 1. Conforms
- 2. Conform As Noted
- 3. Revise and Resubmit
- 4. Rejected

5. Review Not Required

- M. The Contractor shall be responsible for correctness of dimensions other than principal controlling dimensions and properties described on the Contract Drawings, and shall call the attention of the Owner's Representative and Architect to errors and discrepancies that be may discover therein.
- L. The Contractor shall have no claim for damages that may result from following an error except for an error in principal controlling dimensions and properties shown on the Contract Drawings.
- N. The Contractor is responsible for: (i) confirming and correlating quantities and dimensions; (ii) selecting fabrication processes, manufacturing details and workmanship, and techniques of construction; and, (iii) properly coordinating and synchronizing the work in accordance with requirements expressed in the Contract Documents
- O. Actions which change Contract Price, or Prices, under any Pay Item, or Items, or time for completing performance, shall be brought to the Owner's Representative and Architect's attention before proceeding.
  - 1. Carrying out of the Work or ordering of materials before such approval may constitute a cause for rejection of the Work or materials.
- P. The Contractor shall be responsible, and bear all cost of damages, which may result from the ordering of any material or from proceeding with any part of the Work prior to review and approval of required submittals.
- R. Shop drawings and other submittals, shall not be issued to the field or used in the Work without the Owner's Representative and Architect's or required consultants' stamp of approval.
- S. A minimum of six (6) copies of approved shop drawing shall be submitted by the Contractor for Owner's use (1 for the A/ E and 5 for the Owner). Additional copies as required by the Contractor and its Subcontractor shall be added to the number specified for Owner's use.
- T. COMMENCEMENT OF WORK
  - 1. No portion of the Work shall be commenced until required submissions are marked "CONFORM" or "CONFORM AS NOTED" by the Architect. If returned copies are stamped



“REJECTED”, or “REVISE AND RESUBMIT”, promptly resubmit submission. Resubmit until transmittals are stamped “CONFORM” or “CONFORM AS NOTED”.

2. The Contractor shall be responsible for, and bear all cost of damages, which may result from the ordering of any material or from proceeding with any part of the Work prior to approval, or acceptance of the necessary submittals.

#### U. COMPOSITE DRAWINGS

1. In the interest of coordination and expediting the Work in all areas, the Contractor shall prepare and submit to the Owner’s Representative composite drawings embodying the Work of the various trades and/ or subcontractors involved.
2. After review, the Owner’s Representative shall distribute prints of reviewed composite drawings to affected trades and/ or subcontractors. Require that involved trades and/ or subcontractors cooperate in preparation of the composite drawings to assure proper coordination between trades and/ or subcontractors. Participating trades shall indicate their approval on these composite drawings.
3. Prepare composite drawings and installation layouts when required to solve field conditions. Such drawings shall include dimensioned plans, sections and elevations, shall indicate layout and dimensions of ductwork with relationship to plumbing, heating, and chilled water piping, and shall give complete information, particularly size and location of sleeves, inserts, attachments, openings, and structural interference.
4. Prepare composite drawings at a scale of not less than 3/ 8 in. = 1 ft. 0 in. Show components at verified field locations. Ensure allocation of adequate space for clearance, connection, maintenance, and accessibility.
5. On composite drawings, include the following:
  - a. Building structure; finishes and access doors.
  - b. Piping systems, including valves and hangers.
  - c. Ductwork, including dampers and hangers.

- d. Electrical distribution, including pull boxes.
  - e. Mechanical and electrical equipment.
  - f. Note the sequence of installation when necessary.
6. Composite drawings and field installation layouts shall be coordinated in the field by designated Contractor and subcontractors for consistency and proper installation relationships based on field conditions. They shall be checked for accuracy and approved by affected subcontractors, trades, etc., before submission.

#### V. CERTIFICATION OF COMPLIANCE

- 1. When required, the Contractor shall furnish authoritative evidence in the form of manufacturer's certificates of compliance that materials to be used in the Work have been manufactured and tested in conformity with the requirements appearing in the Contract Documents and are certified acceptable.
- 2. Certificates shall include copies of the results of physical tests and chemicals analyses, where necessary, that have been made directly on the product, or on similar products, being fabricated by the manufacturer.
- 3. Certificates shall be delivered to the Construction Manager prior to installation of material or equipment to which they refer.
- 4. Certificates of compliance shall contain the following information:
  - a. Name of Project to which material is consigned and Contractor to whom material is supplied.
  - b. Kind of quality of material represented by the certificates.
  - c. Shipment identification, label or seal marking.
  - d. Date and method of shipment and means of identifying the consignment.
  - e. Statement that the material has been tested and found in conformity with the pertinent contractual requirements stated in the certificate.

- f. Signature of a person having legal authority to bind the supplier.
- g. Signature attested to by a Notary Public or other properly authorized person.
- h. Notarized certificates of specific manufactured products shall be accompanied with appropriate manufacturer's literature and shall state required information relating to the material being supplied.
- i. Certifications shall simply state that the items offered meet contractual requirements.
- j. A specimen of a notarized certificate is attached as "Exhibit A" to this Section. To be acceptable, the certificate shall, unless otherwise approved, be prepared in the form indicated by this specimen on the official letterhead of the supplier, material man, subcontractor, or manufacturer. No portions of the certificate may be omitted.
- k. Submit certificates in triplicate. Individually sign and notarize each copy.
- l. Certificates shall not be binding or conclusive on the Owner and may be rejected at any time by the Architect if incorrect, improper or otherwise unsatisfactory in his opinion.
- m. All required submittals are to be 100% submitted and approved within (90) ninety calendar days of contract award date.

4.10.6 The Contractor shall not use the Contract Drawings for submission of shop drawings. All shop drawings sizes shall be in multiples of 9" X 12", or as otherwise approved by the Architect/ Engineer.

4.10.7 If the Contractor desires to make any deviations or changes from the requirements of the Contract Documents, he shall obtain the consent of the Contracting Officer to such changes, in writing, before submitting Drawings showing such proposed changes. All Drawings submitted by the Contractor shall have been checked and approved by him before submission. The Drawings and Specification references shall be noted on all submissions. Failure to comply with these instructions will be sufficient reason to return such Drawings to the Contractor without any action being taken.

4.10.8 This step-by-step procedure shall be followed in the development and submittal of the “as-built drawings.”

1. The Contractor shall use a set of Plans previously discussed in 1.2.5 for use in recording any changes to the Contract Documents. These plans shall be kept at the job site and continually annotated, (marked up) indicating any and all deviations from the original plans and adding information relative to the precise location of utilities, etc. All below grade utilities shall be located as to depth and horizontally to an existing permanent feature.
2. The Contractor shall prepare a shop drawing “master sheet”, the same size as the original drawings, for use as a record and cross reference between shop and original drawings, i.e., if a shop or an erection drawing is to be used as an “as-built”, information identifying the precise drawing shall be listed on the master sheet clearly referring to a sheet in the contract drawings.
3. These “marked-up” drawings and a copy of the “master sheet” shall be dated and sent to the A/ E for review. The Contractor shall certify as to their accuracy by signature there-on.
4. After the A/ E is satisfied with the accuracy of the information submitted, the Contractor will then transpose such information from the Contractor’s marked up drawings to the original drawings and transmit same to the University. These drawings and two copies of the shop and/ or erection drawings submitted by the Contractor to the University shall constitute the “as-builts”. "As - builts" shall also be submitted in CAD form (Version to be determined by Owner).
5. Any shop or erection drawings used as “as-builts” shall be dated and shall have the name of the Contractor imprinted there-on, if she/ he is not the originator.

4.11 SAMPLES

4.11.1 The Contractor shall furnish on a timely basis, for approval, all Samples as directed. The Work shall be in accordance with approved Samples. Such Samples shall be submitted promptly to the Contracting Officer, through the Architect/ Engineer, at the beginning of the Work, so as to give the Contracting Officer time to examine them. Any list of Samples prepared by the Architect/ Engineer is for the Contracting Officer's

convenience only, and shall not be construed as limiting the number of Samples which the Contractor shall furnish.

4.11.2 The Contractor shall proceed with the Work in accordance with the approved sample. Samples shall show true character, quality and the standard proposed. If rejected, the Contractor shall promptly prepare new or altered samples until acceptance. Approval of material samples is for quality, color and finish characteristics generally, and does not act to modify contract requirements except by written reference to deviations. Attach labels indicating the name and type of materials represented, place of origin, and names of the producer, the Contractor, the building or Work for which the material is intended and when applicable for the location where it will be installed. Identify samples by project name. Approved samples in good condition, marked for identification, may be used in the Work.

4.12 MISCELLANEOUS DRAWINGS, CHARTS AND OPERATING MANUALS

4.12.1 Shop drawings for Plumbing, HVAC, Electrical and other machinery and mechanical equipment items requiring utility service connections, shall be accompanied by manufacturer's certified Shop Drawings, indicating accurate locations and sizes of all service utility connections.

4.12.2 Prior to installing service utilities or other piping, etc. through structural elements of the building, the Contractor shall prepare and submit, for approval of the Architect and Structural Engineer, accurate dimensioned Drawings indicating the positions and sizes of all sleeves and openings required to accommodate their Work and installation of their piping, equipment, etc. and all with reference to the established dimensional grid of the Building. Such Drawings must be submitted in sufficient time to allow proper coordination with reinforcing steel Shop Drawings and proper placing in the field.

4.12.3 The Contractor shall provide a complete set of inked or typewritten control valve, circuit diagrams, one line diagrams and color coding charts of piping and wiring. These shall be framed under glass and installed where directed.

4.12.4 Four (4) copies of all Operating and Maintenance Manuals, as identified and described in the Contract Specifications, are to be furnished by the appropriate contractors. Operating and Maintenance Manuals shall include a complete description of all systems and equipment; diagrams indicating connectors, oiling requirements, types of lubricants to be used, and method of operating equipment. These manuals must be submitted to the Architect/ Engineer for review and approval at the earliest date possible but in all cases prior to final acceptance. Included within the manuals shall be a list of names, addresses and telephone numbers of

Subcontractors involved in the installation and firms capable of performing services for each mechanical item. As a pre-condition to the acceptance of a facility for beneficial use, Contractors shall provide a "throw-away" copy of operations and maintenance manuals to allow the University to operate the equipment prior to receiving the hard bound copies required by the Contract.

4.13 OPENINGS-CHANNELS-CUTTING AND PATCHING

4.13.1 The Contractor shall be responsible for furnishing and setting of sleeves, built-in items, anchors, inserts etc. for their Work and for all cutting, fitting, patching, finishing or adjusting of their Work in a new and/ or existing construction, as required for the completed installation.

4.13.2 The Contractor shall close, build in and finish around or over all openings, chases, channels, pockets, etc., after installation has been completed.

4.13.3 Approval in writing must first be obtained by the Contractor from the Architect/ Engineer before cutting or boring through any floor beams, roof beams, floor construction, roof construction or supporting members.

4.14 TESTS AND INSPECTIONS

4.14.1 The Contractor shall notify the University, in writing, of all Work required to be inspected, tested or approved. The notice shall be provided no later than five (5) Working days prior to the scheduled inspection, test or request for approval. The Contractor shall bear all costs of such inspections and tests.

4.14.2 When mechanical, electrical or other equipment is installed, it shall be the responsibility of the Contractor to maintain, warrant and operate it for such period of time as required by the contract documents or as necessary for the proper inspecting and testing of the equipment and for adequately instructing the University's operating personnel. All costs associated with the maintenance, warranty, operations, inspection and testing of equipment in addition to instructing University personnel shall be borne by the Contractor.

4.14.3 When the University requires special or additional inspections, testing or approvals, it will, in writing, direct the Contractor to secure the service for such special or additional inspections, testing or approvals and the Contractor shall give notice as provided for in 4.14.1. In the event such special or additional inspections or testing reveal a failure of the Work to comply with the terms and conditions of the contract, the Contractor shall

bear all the costs thereof, including all costs incurred by the University made necessary by such failures; otherwise the University shall bear all costs of such special or additional testing and an appropriate change order will be issued.

4.14.4 The Contractor shall acquire inspection or testing services using only those firms pre-qualified by the **DPMC**. Failure to use such a firm shall be grounds for rejection of the inspection or test as nonconformance.

4.14.5 All submittals of inspections and test reports or requests for approval, shall be accompanied by a certification signed by the Contractor attesting to their knowledge of the submittal, acceptance of its findings and acknowledgment that material tested meets the required standards and certify the report's representation of the facts. Failure to provide the written certification shall be grounds for rejection of the submittal.

4.14.6 In addition to the above the Contractor agrees to insert in all contracts/ purchase orders for inspection and testing the requirement for the inspection or testing firm to submit, in conjunction with the report to the Contractor, a copy of the report directly to the University. The copy shall be held pending receipt of the Contractor's certification of the report. Further, the Contractor agrees to require all reports to be submitted within fourteen (14) calendar days of the test or inspection. Failure to provide reports within the required time shall be addressed pursuant to Article 10 of the General Conditions.

4.14.7 Testing requirements for real property installed equipment (RPIE) to be furnished by the Contractor, when such testing is required by code, Contract or the manufacturer shall be performed by a pre-qualified testing laboratory or in the absence of such by the manufacturer or its authorized representative. The Contractor shall provide the five-day notice to the University and the University shall witness all tests.

4.15 CONCRETE/ BITUMINOUS PAVING/ SOILS COMPACTION AND OTHER STRUCTURAL TESTING

4.15.1 All such testing shall be accomplished in accordance with the provisions of paragraph 4.14.

4.16 EQUIPMENT-MATERIAL

4.16.1 The Contractor warrants to the Contracting Officer and the Architect/ Engineer that all materials and equipment furnished under the Contract will be new, unless otherwise specified, and that all Work will be of good quality, free from faults, defects, and in conformance with Contract Documents. All Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective and rejected by the Contracting Officer or the

Architect/ Engineer. If required the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment. This warranty is not limited by the provisions of the other paragraphs contained herein.

- 4.16.2 The original and six (6) copies of request for approval of materials prepared on the appropriate form shall be forwarded to the Architect/ Engineer for approval. Each item of material listed shall be marked "As Specified" or "Unspecified" as the case may be.
- 4.16.3 The Contractor shall furnish and deliver the necessary equipment and materials in ample quantities and as frequently as required to avoid delay in progress of the Work and shall store them so as not to cause interference with the orderly progress of the Work.
- 4.16.4 The University will not sign for, nor will it be responsible for any material, hardware or other item(s) shipped to or delivered directly to the University. The University will not be responsible for the loss of any material, hardware or any other items(s) prior to its final incorporation into the project and acceptance as specified within the Contract Documents. The Contractor must replace lost material, hardware or other items(s) immediately and at their expense.
- 4.16.5 The Contractor shall furnish and pay for all necessary transportation, storage, scaffolding, centering, forms, water, labor, tools, light and power mechanical appliances and all other means, materials and supplies for properly prosecuting the Work under this Contract, unless expressly specified otherwise. The Contractor shall make arrangements to have representatives of their firm at the site to accept delivered materials.
- 4.16.6 **Manufactured products of the United States**, whenever practicable, shall be used in this Work. Wherever practicable, preference shall be given at all times to material and equipment manufactured or produced in the State of New Jersey, where such preference is reasonable and will best serve the interest of the University.
- 4.16.7 No materials, equipment or supplies for the Work shall be purchased by the Contractor or any Subcontractor subject to any lien or encumbrance or other agreement by which an interest is retained by the Seller. The Contractor warrants, by signing their requisition for payment, that he has good and sufficient title to all such material, equipment and supplies used by him in the Work, free from all liens claims or encumbrances.
- 4.16.8 Any product, material, or equipment specified by reference to the number, symbol, or title or a specific standard such as commercial standard, federal specifications, trade association standard, or other similar or related construction industry standards, shall comply with



requirements in the latest revision thereof and any amendment or supplement thereto in effect on the date of the Bid Advertisement for this project. The standards referred to, except as modified in the specifications, shall have full force and effect as though printed herein. These standards are not furnished to the contract bidders for the reason that they are assumed either to be familiar with the requirements or will secure copies of the referenced standards prior to the bidding. For any product, materials or equipment specified by reference to standards, the Contractor shall furnish satisfactory evidence of compliance with the particular standard specifications.

4.16.9 The policy regarding restrictive specifications shall operate on the basis of what is in the best interest of the University and shall function as follows:

- a. When the "or approved equal" phrase is appended to a material, equipment or product designation, no approval for a substitute item shall be given prior to the awarding of a contract. After the contract has been awarded, the Contractor may submit a request to use materials, equipment, or products other than those specified only for those items which have the phrase "or approved equal" appended to it. The material, equipment or product shall only be considered if it is in no way inferior in quality or style to those specified and it shall be the burden and obligation of the Contractor to demonstrate the lack of substantial difference in quality and style between the proposed substitute item and that specified.
- b. The term "or approved equal" is not necessarily limited to the physical or technical properties of the product or material, but is construed to encompass the finish, color, texture and other pertinent qualities in like regard. Failure to satisfy in any one respect may be sufficient cause for rejection of substitute materials.

4.16.10 Fiber, wood, and plastic plugs are prohibited for use as fastening devices.

4.17 SUBSTITUTIONS

4.17.1 In the event a Contractor should propose a substitution for the specified equipment or materials, it shall be their responsibility within ten (10) days to submit proof of equality, and to provide and pay for any tests which may be required by the Contracting Officer at no cost to the University in order to evaluate and A/E to approve such proposed substitution.

4.17.2 Where any particular brand or manufactured article is specified, it shall be regarded as a standard.

4.17.3 The application for approval of substitution by the Contractor shall include the following information:

- a. Complete specific information.
- b. Identify the Specification paragraph and section.
- c. Attach data indicating, in detail, how the substitution differs from the article specified.
- d. A detailed itemization of the amount of credit must be shown.
- e. When the proposed substitution involves a change in the scope of the Work of this or any other Contractor, include a statement that the Contractor undertakes and agrees to be responsible for any and all added costs involved by reason of the change in the Work, the Work of other Contractors and trades, including redesign, if any.
- f. A statement that the Contractor will submit proof of equality and will have such test performed at their own expense as may be required for approval.
- g. The Contractor shall not base their bid on proposed or previous substitutions, which may have been approved on previous projects. Bids shall be based solely on Plans and Specifications for this subject project.

4.18 SOIL BORINGS

4.18.1 Soil borings, test pits or other subsurface information may be secured by the University prior to design and construction of a project and may be included in the Contract Documents for the Contractors use. The Contractor assumes full responsibility for interpretation of said borings and the University shall have no responsibility or liability should the data provided prove to be incorrect or unrepresentative.

4.19 PROTECTION OF CONTRACTOR'S PROPERTY

4.19.1 The Contractor shall adequately secure and protect their own tools, equipment, materials and supplies and require their subs to do likewise. The Owner assumes no liability for any damage, theft or injury to the Contractor's property.

4.20 PATENTS

- 4.20.1 The Contractor shall hold and save the University, Architect/ Engineer, and CM and its officers, agents, servants, and employees harmless from liability of any nature of kind, including cost and expenses for, or on account of, any patented or unpatented invention, process, article, or appliance manufactured or used in the performance of the Contract.
- 4.20.2 License and/ or Royalty Fees for the use of a process which is authorized by the University must be reasonable, and paid to the holder of the patent, or their authorized license, direct by the University and not by or through the Contractor.
- 4.20.3 If the Contractor uses any design, device or materials covered by letters, patent or copyright, he shall provide for such use by suitable agreement with the University of such patented or copyrighted design, device or material. It is mutually agreed and understood that, without exception, the Contract Prices shall include all royalties or cost arising from the use of such design, device or materials, in any way involved in the Work. The Contractor and/ or their Sureties shall indemnify and save harmless the Owner, Architect/ Engineer, and CM of the project from any and all claims for infringement by reason of the use of such patented or copyrighted design, device or materials or any trademark or copyright in connection with the Work agreed to be performed under this Contract, and shall indemnify the University for any cost, expense or damage which it may be obliged to pay by reason of such infringement at any time during the prosecution or after the completion of the Work.
- 4.21 RIGHT TO AUDIT
- 4.21.1 The University reserves the right to audit the records of the Contractor in connection with all matters related to this contract. The Contractor agrees to maintain their records in accordance with generally accepted accounting principals, for a period of not less than three (3) years after receipt of final payment. "Generally Accepted Accounting Principles" is defined as follows: Accounting records must identify all labor and material, costs and expenses, whether they be direct or indirect. The identity must include at least the project number for direct expenses and/ or account number for indirect expenses. All charges must be supported by appropriate documentation, including, but not limited to canceled checks.
- 4.21.2 The Contractor shall develop, maintain and make available to the Contracting Officer upon request such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, change orders, all original estimates, takeoffs, and other bidding documents, all Subcontractors and Supplier Contracts and changes, records showing all costs and liabilities incurred or to be incurred in connection with the project including all Subcontractor and Supplier costs, payment records and records showing all costs incurred in labor and personnel of any

kind, records and other data as the University may request concerning the Work performed, or to be performed, under this Contract.

- 4.21.3 The Contractor acknowledges and agrees that no claim for payment which is premised to any degree upon actual costs of the Contractor shall be recognized by the University except and to the extent, that such actual costs are substantiated by records required to be maintained under these provisions.
- 4.21.4 The Contractor shall require each Subcontractor, to be bound to the Contractor and to assume towards the Contractor all the obligations and responsibilities which the Contractor assumes by the Documents to the University and its contractual parties.
- 4.21.5 The Contractor shall not grant to any Subcontractor terms more favorable than those extended to the Contractor by the University.
- 4.21.6 The Contractor acknowledges and agrees that the Contractor's obligation to establish, maintain and make available records and the University's right to audit as delineated herein, shall extend to actual costs incurred by Subcontractors in performing the Work required under the contract or any supplemental agreement thereto. The Contractor shall require, in all subcontracts, that the Subcontractor establish, maintain and make available to the University all records as defined and delineated herein relating to all Work performed by the Subcontractors including Work performed by a Sub-Subcontractor.

4.22 CONTROL WIRING

- 4.22.1 The Contractor who furnishes and installs mechanical equipment, including but not limited to heating, ventilating and air conditioning systems, ATC systems, boilers, remote monitoring systems, and so forth, which systems require electrical control wiring, shall include the cost of all such control wiring and its installation in their proposal. The Contractor shall employ a Subcontractor approved by the State for all such control wiring. The Subcontractor shall provide a Final Certificate of Electrical Inspection of the control wiring.

4.23 STANDBY PERSONNEL

- 4.23.1 The Contractor who is obligated to employ standby personnel by trade agreement to which he is a party shall determine and include all such costs thereof in their bid proposal. No Contractor shall, at any time, make a claim to the University for costs relating to standby maintenance, or standby supervision, for electric motor-driven or other equipment. The University, under no condition, will entertain or consider a claim in this regard, unless such claim is made as a result of the University's

unreasonable refusal to accept Beneficial Occupancy of the completed project.

4.24 GUARANTEE

4.24.1 Neither the Final Certificate of Payment, nor any provision in the Contract Documents, nor partial or entire occupancy of the premises, by the University, shall constitute an acceptance of Work not done in accordance with the Contract Documents. Nor shall it relieve the Contractor of liability with respect to any expressed or implied warranties or responsibility for faulty materials or Workmanship. The University will give notice of observed defects with reasonable promptness. The Surety's obligation shall continue beyond final acceptance to the extent that the Contractor would have had such obligation.

4.24.2 The Contractor and each individual Subcontractor shall guarantee and warrant, in writing, the Work to be performed and all materials to be furnished under this Contract against defects in materials or Workmanship and to pay for the value of repair of any damage to other Work resulting there from for a period of one (1) year from date of project acceptance, in addition to guarantees otherwise specified. All guarantees, bonds, etc., required by the specifications shall be in writing in requisite legal form, and delivered to the Contracting Officer at the time of submission of requisition for final payment. All Subcontractor's and Materialmen's guarantees, bonds, etc., shall be underwritten by the Contractor, who shall obtain and deliver same to the Contracting Officer before the Work shall be deemed finished and accepted.

4.24.3 The Contractor shall, at their own expense and without cost to the University, within a reasonable time after receipt of written notice thereof, make good any defects in material or Workmanship which develop during stipulated guarantee periods, as well as any damage to other Work caused by such defects or by their repairs. Any other defects in material Workmanship, not reasonably observable or discovered during the guarantee period, shall be repaired and/or replaced at the Contractor's expense and such shall be completed within a reasonable time after written notice is given to the Contractor.

4.24.4 It is anticipated that certain permanent equipment will have to be activated during construction of the project to support construction operations. This would particularly be the case with respect to lighting and those portions of the permanent heating system required to provide temporary heat for interior finish operations. Regardless of when equipment is activated for use during construction, all equipment warranties must extend for the time periods required in these Specifications starting as of the date of occupancy or final acceptance

(whichever is the earliest). All Contractors shall include in their base bids all costs necessary to provide extended warranties as necessary for any equipment which may be activated prior to final building acceptance by the University.

END OF ARTICLE 4

## ARTICLE 5

### SPECIAL RESPONSIBILITIES

#### 5.1 Supervision

- 5.1.1 The Contractor has the responsibility for being the supervisor, manager, overseer, coordinator and expediter of the total construction process and all of its parts, in accordance with the Contract Documents. In executing the duties assumed by these responsibilities the Contractor shall provide sufficient executive and supervisory staff in the field to accomplish efficient and expeditious handling of these matters. There shall be at least one (1) full-time Project Manager assigned by the Contractor, as well as the field staff referred to above. The Project Manager shall attend all Progress Meetings. The Contractor shall include in their bid an amount sufficient to cover their cost of furnishing necessary administrative and supervisory forces to coordinate their own Work and that of their Subcontractors
- 5.1.2 The Contractor shall be responsible for providing and maintaining unobstructed traffic lanes for the designated Construction Access Routes. They shall provide and maintain grading, compaction, removal of snow and debris etc., as required to maintain the serviceability condition of the access roadbed, as well as pedestrian ways.
- 5.1.3 The Contractor shall construct, erect and maintain one (1) sign at the Project Site, as shown on the Drawings and located as directed. Painting shall be done by a professional sign painter, with two (2) coats of exterior paint, colors, letter face and layout as shown. No other signs will be permitted at the Site. Upon completion of the Project, and when directed the Contractor shall remove the sign. Should there be a change in the listed officials, the Contractor shall make appropriate changes to the sign at their expense.
- 5.1.4 The Contractor, at their expense, shall provide and maintain necessary temporary dustproof partitions around areas of the Work in any existing building or in new building areas as directed.
- 5.1.5 The Contractor accepts sole responsibility for repair of uncontrolled dislodgment, cracking, delamination and peeling of finished surfaces such as concrete, precast concrete, cast and natural stone, masonry, millwork, plaster, glass and applied finishes such as paint and special coatings, within the limits of the specified guarantee periods, regardless of the cause.
- 5.1.6 The Contractor shall be responsible for replacement of all broken glass installed regardless of cause and shall replace all broken, scratched or otherwise damaged glass before the completion and acceptance of the

Work. They shall wash all glass on both sides at completion, or when directed, removing all paint spots, stains, plaster, etc.

5.2 LAYOUT, DIMENSIONAL CONTROL AND VERIFICATION,  
SURVEYOR'S CERTIFICATION

5.2.1 The Contractor shall be responsible for locating and laying out the building and all of its parts on the site, in strict accordance with the Drawings, and shall accurately establish and maintain dimensional control. They shall employ and pay for the services of a competent and licensed New Jersey Engineer or Land Surveyor (who shall be approved by the Owner) to perform all layout work, and to test the levels of excavations footing base plates, columns, walls and floor and roof lines, and furnish to the Architect/ Engineer, as the Work progress, certificates that each of such levels is as required by the Drawings. The plumb lines of walls, etc., shall be tested and certified by the Surveyor as the Work progress.

5.2.2 The Engineer or Surveyor, in their layout work, both on the site and within the building, shall establish all points, lines, elevations, grades and benchmarks for proper control and execution of the Work. He shall establish a single permanent Bench Mark as directed to which all three (3) coordinates of dimensional control shall be referred. They shall verify all Owner-Furnished topographical and utility survey data and all points, lines, elevations, grades and bench marks; should any discrepancies be found between information given on Drawings and the actual site or field conditions, the Contractor shall notify the Architect/ Engineer of such discrepancy, and shall not proceed with any Work affected until receipt of written instructions from the Architect/ Engineer.

5.3 PHOTOGRAPHS

5.3.1 The Contractor shall submit with each monthly application for payment, until the work is completed, progress photographs of the construction in duplicate to the Contracting Officer, giving up to ten (10) views as selected by the Architect/ Engineer.

5.3.2 The photographs shall be 8" x 10", mounted on muslin, and the negative shall bear the date of the exposure, and the name of the project, the Contractor and the Architect/ Engineer.

5.3.3 Digital photographs, in an approved format, maybe substituted for the above if approved by the Architect/ Engineer.



5.4 INSPECTION OF ROADWAY SUBGRADES

5.4.1 The Contractor shall notify the Architect/ Engineer forty-eight (48) hours prior to anticipated completion of all roadway sub grade Work. The University may request an inspection by an appropriate agency to insure that the sub grade meets the compaction standards. All subgrades shall be proof-rolled for such inspection. If compaction soils tests are required, these tests will be done by soils testing laboratories through the University, unless contrary provisions are made elsewhere in the specifications. The Contractor shall not proceed with base course until the results of the compaction tests are determined and sub grade approved by the University.

5.5 SITE SECURITY

5.5.1 The Contractor shall provide, maintain and oversee security at the site. The project site shall be fenced as specified below (6.9) and the Contractor shall control access when gates are unlocked or open.

5.6 SITE USE

5.6.1 The Contractor is responsible to check and verify reasonably observable conditions outside the Contract Limit Lines to determine whether any conflict exists with the Work they are required to perform under the Contract. This includes a check on elevations, utility connections, and other site data. The Contractor shall notify the Contracting Officer in writing of any conflict. All discrepancies or conflicts relating thereto shall be brought to the attention of the Contracting Officer prior to the execution of the Contract. In the absence of such notice, all required Work, as shown on the Drawings and in the Specifications, shall be performed within the Contract cost. The Contractor shall confine construction equipment, storage and work to the project site absent written approval from the University. Any request by the Contractor to use areas outside the project site must be described in written form and included with the Contractor's bid.

END OF ARTICLE 5

## ARTICLE 6

### TEMPORARY FACILITIES, UTILITIES AND SERVICES

#### 6.1 FIELD OFFICES

6.1.1 The Contractor will provide, on Site, and maintain during the Project Construction, a suitable weather-tight Field Office conveniently located and shall maintain therein a complete set of Contract Documents including plans, specifications, CPM network diagrams, change orders, logs, other details and correspondence. The Field Office shall contain approved and safe heating facilities and lighting, convenience outlets, fire extinguisher, minimum of two (2) operating windows of 15 s.f. each, outside door, handle, hasp and padlock. The Field Office may be removed upon enclosure of a Building at which time if directed by the A/E contents and operations will be transferred to the Interior of the Building.

6.1.2 The Contractor will provide, on site, suitable, separate, weather-tight, insulated (floor, walls, ceilings) field office facilities (12'x 50' minimum), with "meeting room", toilet, for the use of the A/ E, CM, and University Personnel. Furnish approved and safe means of lighting, heating, (available beyond regular Working hours), and fire extinguishers, operating windows of 15 s.f. each, two (2)12,000 BTU air-conditioning units, 3' X 5' plan-tables, conference table, fifteen (15) folding chairs, desk, chair, four (4) drawer file cabinet, outside door handle, hasp and padlock. The Contractor shall remove Field Office upon enclosure of the Project Building and relocate contents and operations of Field Office to interior of the Project Building when directed by the Contracting Officer. The Contractor shall be responsible for the maintenance of both offices and the Meeting Room, janitor's service and other incidentals. Project related calls made by the University and the A/ E or their Consultants shall be made at the General Contractor's expense.

6.1.3 The Contractor's Site Superintendent shall have access to a cellular phone at all times.

#### 6.2 STORAGE SHEDS, TOOL SHEDS, SHOPS, EMPLOYEES SHEDS

6.2.1 The Contractor will provide and maintain, for its own use, suitable and safe temporary storage, tool shops, and employee's sheds. The Contractor shall properly maintain them, and remove them at completion of the Work. Locations shall be directed by the Owner. Rooms in the building may be used as shops and storerooms, with the approval of the Owner. The Contractor making use of these areas shall

be responsible for correcting defects and damage caused by such use and for keeping these areas clear and clean.

6.3 STORAGE AREAS, EMPLOYEES' VEHICULAR PARKING, EQUIPMENT MARSHALING AREAS, EXCAVATION BORROW/ SPOILS DESIGNATED AREAS

6.3.1 The Contractor shall be responsible for providing for their own requirements. The Contractor shall locate these areas, to suit project requirements, with the University's concurrence.

6.3.2 THERE IS NO CONTRACTOR PARKING PERMITTED ON CAMPUS, INCLUDING WITHIN THE CONTRACT LIMIT LINES, LOT 1, NOR THE PARKING GARAGE. The Contractor will be responsible to provide own parking. The Contractor employees may park, at its own expense, in Lot 3 located on West Side Avenue.

6.4 TEMPORARY TOILET FACILITIES

6.4.1 The Contractor shall provide and pay for suitable temporary toilets, at approved locations on the site, prior to the start of any field Work. They shall comply with State and Local laws. The Contractor will be responsible for maintenance, removal and relocation as described hereinafter.

6.4.2 Toilets shall be serviced by a qualified firm.

6.4.3 Toilets shall be of portable chemical type, one (1) for each twenty (20) on-site employees and mounted on skids, with doors, and each having a urinal and a water closet.

6.4.4 Each unit shall be serviced at least twice a week, including removal of waste matter, sterilizing, recharging tank, refilling tissue holders, and thorough cleaning and scrubbing of entire interior, which shall be maintained in a neat and clean condition. When toilets are connected to water and sewer lines, take precautions to prevent freezing. Remove units from Site at completion of Work or when so directed.

6.4.5 Toilet facilities in a multiple-story building shall be located on no less than every other floor, unless otherwise directed.

6.4.6 Relocate facilities inside building and connect to water and sewer as soon as the Work will allow as approved by the A/ E.

6.4.7 Workmen are not to use the finished bathroom and toilet facilities in the project buildings (reasonable steps must be taken by the Contractor to enforce this rule).

6.5 DRIVES AND WALKS

6.5.1 The Contractor shall be responsible for keeping all roadways, drives and parking areas within or proximate to the site free and clear of debris, gravel, mud or any other site materials by insuring that all measures reasonably necessary are taken to prevent such materials from being deposited on such surfaces including, as may be appropriate, the cleaning of vehicle wheels etc., prior to their leaving the construction site. The Contractor will be held accountable for any citations, fines, or penalties imposed on the University for failing to comply with local rules and regulations.

6.5.2 Should the Contractor elect to commence construction of permanent driveways, parking areas or walks, other than general grading of temporary shop and trailer, etc. areas, they shall not do so without the approval of the Contracting Officer. He shall not do so without having prepared the sub grade, nor will he be relieved from any responsibility for providing additional materials or of reworking the sub grade prior to completion, if so required to make the improvements conform fully with the Specifications.

6.5.3 The Contractor shall obtain permission, in writing from the University, before using any existing driveways or parking areas not specifically designated for such use in the Contract Documents for construction purposes. He shall maintain such driveways and areas in good condition during the construction period and, at completion of the Project, shall leave them in the same condition as at the start of the Work. Conditions before use should be carefully photographed or documented by the Contractor.

6.6 TEMPORARY LIGHT AND POWER

6.6.1 The Contractor shall extend temporary electrical service to the construction site and building or buildings at locations approved by the Contracting Officer; temporary electrical service shall be independent of the permanent service. The location of the temporary power meter(s) must be approved by the University. The type of power required shall be provided by the Contractor. Temporary light and power installations, wiring, and miscellaneous electrical hardware must meet the Electrical Code. Electrical characteristics shall be provided to meet all temporary light and power reasonably required as herein and hereinafter specified, or as included under Supplementary General Conditions. The Contractor shall provide the necessary distribution facilities and meter, and shall pay

the cost of running temporary services from the nearest utility company power pole. All costs shall be included in their bid.

6.6.2 Power outlets shall be fed independently of the temporary lighting system. The incoming service and main distribution switches and panels shall be sized by NEC requirements.

6.6.3 Contractor shall observe the requirements of the Federal Occupational Safety and Health Act of 1970 with regard to temporary light and power.

6.7 TEMPORARY HEAT

6.7.1 Heating of field office, storage spaces, concrete and masonry materials and Working area heating, as required, shall be provided by the Contractors. Field offices shall be heated to a minimum 68 degrees F and shall be air conditioned in the summer.

6.7.2 All temporary heating equipment shall be NFPA approved and connected to approved flues to the atmosphere. Gas cylinders within the building shall not exceed 100lb. capacity, shall have Interstate Commerce Commission approval and shall be fitted with a permanent cap to protect the valve when not in use. Heaters shall be approved by a recognized testing laboratory and must be equipped with a positive shut-off safety valve. Cylinders and heaters shall stand at least six (6') feet apart and be connected with two (2) braid neoprene hoses that will withstand 250 psi test pressure. Cylinders shall be secured in place to prevent them from being dislodged or otherwise upset.

6.7.3 Storage of cylinders within the building will not be permitted at any time. Fire extinguishers shall be provided by the contractor on each floor where heaters are used, and the area must be adequately ventilated.

6.7.4 The Contractor shall train at least two (2) dependable persons to oversee temporary heat operations.

6.7.5 If by the sixtieth (60th) calendar day after the building, buildings or major unit thereof, is (are) permanently enclosed and the Contracting Officer has determined that heat is required for the proper execution of the construction Work, the Contractor shall provide the heat. A building, or major unit thereof, shall be considered "permanently enclosed" when; (a) the exterior and enclosure Work including walls, windows, glazing, louvers, doors have been permanently installed; (b) a permanent building roof has been completed and satisfactorily tested; (c) the permanent building roof drain system has been completed and made operational; (d) all building openings have been closed such that the building is weather tight.

- 6.7.6 When the building or a major unit, including the boiler room area, is PERMANENTLY enclosed as herein defined and appropriate notice has been given, it shall be the obligation of the Contracting Officer to so acknowledge at a job conference. The minutes of said meeting shall contain such acknowledgment, that the building or a major unit is proper PERMANENTLY enclosed
- 6.7.7 The University reserves the right to permit the substitution of limited temporary enclosures in lieu of permanent construction for the attainment of a permanently tight building if such action is deemed by the University to be in the best interest of the project. This action will not be such as to create a future jeopardy to the environmental integrity of the building as construction proceeds.
- 6.7.8 Contractor shall provide such heat to a minimum temperature of 45 degrees F, or to such higher temperature, not to exceed 75 degrees F, as may be directed by the Contracting Officer for the proper conduct and protection of the Work. They shall do so until such time as all the Work is complete and accepted and he is relieved of this requirements by the Contacting Officer, in writing.
- 6.7.9 Seven (7) days prior to acceptance by the University of the heating system as substantially complete, the Contractor shall replace disposable filters with clean filters of the type specified or turn over spare sets of filters to the University as directed by the Contracting Officer.
- 6.8 TEMPORARY ENCLOSURES
- 6.8.1 Whenever necessary, in order to maintain proper temperatures for the prosecution of the Work, or for the protection thereof, the Contractor shall furnish and maintain temporary enclosures for all openings in exterior walls that are not enclosed with finishing materials. Temporary wood doors shall be provided at door openings.
- 6.9 TEMPORARY CONSTRUCTION FENCE & SIGNAGE
- 6.9.1 The Contractor shall provide and maintain a temporary construction fence, as indicated, to enclose the area at the job site and to guard and close effectively the designated area. The General Contractor shall be responsible for posting appropriate signage restricting access, and shall further be responsible for controlling access to the job site. The Contractor shall provide gates at locations where required for access to the enclosed area. Gates shall be of chain link material, cross-braces, hung on heavy strap hinges, and shall have suitable hasps and padlocks.

6.9.2 The Contractor shall remove the fence upon completion of the Work or at such time before final completion as directed by the Owner. They will repair any lawn, concrete or paving surfaces which may have been damaged.

END OF ARTICLE 6

## ARTICLE 7

### SUBCONTRACTORS

#### 7.1 DEFINITION

7.1.1 A Subcontractor is an individual or firm who has a direct contract with the Prime Contractor, or another subcontractor, to perform any of the Work at the Site.

#### 7.2 CONTRACTOR-SUBCONTRACTOR RELATIONSHIP

7.2.1 The Contractor shall, within thirty (30) days after award of the Contract, notify the Contracting Officer in writing, of the names of Subcontractors, other than those requiring to be listed in the Bid, proposed to perform the principal parts of the Work and of such others as the Contracting Officer may direct. They shall not employ any Subcontractor without prior written approval of the Contracting Officer, or any that the Contracting Officer may, within a reasonable period, reject. Failure of the Contracting Officer to reply within fifteen (15) days of receipt of such names shall constitute notice of approval.

7.2.2 If the Contracting Officer has reasonable objection to any such proposed person or firm, the Contractor shall substitute another Subcontractor to which the Contracting Officer has no reasonable objection. Under no circumstances shall the University be obligated for additional cost due to such substitution.

7.2.3 The Contractor shall make no substitution for any Subcontractor, person or firm previously selected and approved, without written notification to the Contracting Officer and receipt of their written approval for such substitution.

7.2.4 The Contractor acknowledges their full responsibility to the University for the acts and omissions of their Subcontractors, and of persons and firms either directly or indirectly employed by them, equally to the extent that he is responsible for the acts and omissions of persons and firms directly or indirectly employed by him and each Contractor acknowledges they remain fully responsible for the proper performance of the Contract irrespective of whether Work is performed by their own forces or Subcontractors engaged by them.

7.2.5 Nothing contained in the Contract Documents shall create any contractual relationship between any Subcontractor and the University.

7.2.6 By an appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor to be bound to the Contractor by the terms of the Contract Documents and to assume



toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the University, the Architect/ Engineer and any party contracted by the University. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreement with their Sub-contractors.

7.2.7 The Contractor agrees that in the employment of both skilled and unskilled labor, by the Contractor or their Subcontractors, preference shall be given to residents of the State of New Jersey.

7.2.8 Approval by the Contracting Officer of a Subcontractor or material supplier shall not relieve the Contractor of the responsibility of complying with all provisions of the Contract Documents. The approval of a Subcontractor does not imply approval of any material, equipment or supplies.

END OF ARTICLE 7

## ARTICLE 8

### RELATIONSHIP BETWEEN OWNER AND CONTRACTOR

#### 8.1 OWNER'S RIGHT TO PERFORM WORK

- 8.1.1 The University may, and reserves the right to, enter upon the premises at any and all times during the progress of the Work, or cause others to do so for the purpose of installing any apparatus or carrying on any construction not included in these Specifications or for any other reasonable purpose.

#### 8.2 MUTUAL RESPONSIBILITY

- 8.2.1 Before completion of the Work, should it be deemed necessary by the University to do any Work whatsoever, in or about the building or structure, other than as provided for in the Contract Documents, the Contractor shall fully cooperate with such other individual or firm as the Owner may employ to do such Work. The Contractor shall afford said other individual or firm all reasonable facilities for doing such Work. Other than an Extension of Time, the Contractor shall make no claim to the University, as a result of such Work.

- 8.2.2 The Contracting Officer shall at all times have access to the Work whether it is in preparation or in progress, and the Contractor shall provide proper facilities for such access. The Contracting Officer reserves the right to employ the services of a professional consultant to evaluate any phase of the Work, but no such evaluation shall in any way relieve the Contractor of their responsibilities under the Contract. The Contractor shall cooperate with the consultants and provide access to the Work and facilities for inspection. Should any portion of the Work or material be found deficient or defective, the Contractor will pay the applicable fees of such consultant and be responsible for replacing the deficient or defective Work as required.

- 8.2.3 Any costs caused by defective or ill-timed Work shall be borne by the Contractor.

- 8.2.4 If the Contractor should destroy, damage or disturb the Work of the University and any other Contractor in or about the building or premises, the Contractor shall immediately either replace the destroyed Work and make good the damaged and disturbed Work to the satisfaction of the A/ E and the Contracting Officer, or shall reimburse the Contractor whose Work he has destroyed, damaged or disturbed for the expense of replacing such Work.

- 8.2.5 Should a Contractor sustain any damage through any act or omission of any other Contractor having a Contract with the Owner, or through any

act or omission of a Sub-contractor of any Contractor, or through any act or omission of the A/ E, the Contractor shall have no claims against the University for such damage, but shall have a right of action to recover such damages from the causing party or parties, in accordance with 8.4.2, which is included in the Contract with all other such Contractors and the A/ E.

8.3 CONTRACTOR'S CLAIM FOR DAMAGES

8.3.1 Any claims made by a Contractor against the University for damages or extra costs are governed by and subject to The New Jersey Contractual Liability Act, N.J.S.A. 59:13-1 et seq. as well as all the provisions in this contract.

8.3.2 The University shall not be liable to the Contractor for any damages or extra costs caused, by any acts or omissions, by others. The Contractor's exclusive remedy shall be against the culpable party.

8.4 TIME OF COMPLETION-DELAY-LIQUIDATED DAMAGES

8.4.1 If the Contractor fails to complete the work included in a milestone by a milestone completion date specified in the contract, or it fails to substantially complete the project by the substantial completion date specified in the contract, or if it fails to finally complete the construction work by the final completion date specified in the contract, or any extensions of those dates issued in accordance with the contract and the general conditions, the Contractor shall be liable to the University in the sum of one thousand (\$1,000.00) dollars per day, or the sum equal to 1/ 20th of one percent of the total consideration provided for under this contract, per calendar day, whichever is greater, for each and every day that the said Work shall be and remain uncompleted, which said sum shall be treated as liquidated damages and not a penalty, for the loss to the University of the use of premises in a completed state of construction, alteration or repair, as the case may be, and for added administrative and inspection costs to the University on account of the delay; provided, however, that the said liquidated damages provided for herein shall be in addition to other consequential losses or damages that the University may incur by reason of such delay, such as, but not limited to, added costs of the project and the cost of furnishing temporary services, if any. Any such items for which the Contractor is liable may be deducted by the University from any monies due or to become due to the Contractor.

8.4.2 it is hereby understood and mutually agreed by and between the Contractor and the University that the date of the beginning, the dates of required intermediate milestones, and the time for completion, as specified in the Contract of the Work to be done hereunder are ESSENTIAL CONDITIONS of this Contract; and it is further mutually

understood and agreed that the Work embraced in this Contract shall commence on a date no later than that specified in the Notice to Proceed.

- 8.4.3 The Contractor agrees that said Work shall be prosecuted regularly, diligently, and uninterruptedly at such rate of progress as will insure full completion thereof within the time specified. It is expressly understood and agreed, by and between the Contractor and the University, that the time for the completion of the Work herein is a reasonable time for the completion of the same, taking into consideration the average climatic range and usual industrial conditions prevailing in this locality. If the said Contractor shall neglect, fail or refuse to complete the Work within the time herein specified, or any proper extension thereof granted by the Contracting Officer, then the Contractor does hereby agree, as a part of the consideration in the awarding of this Contract, to pay the University the amount specified in paragraph 8.6.1 above, not as a penalty but as liquidated damages for such breach of contract as hereinafter set forth, for each and every calendar day that the Contractor may be held in default after the stipulated date in the Contract for completing the Work.
- 8.4.4 The said amount is fixed and agreed upon by and between the Contractor and the University due to the impracticality and extreme difficulty of fixing and ascertaining the actual damages the University would in such event sustain, and said amount is agreed to be the amount of damages which the University would sustain and said amounts shall be retained from time to time by the University from current periodical estimates.
- 8.4.5 It is further agreed that Time is Of the Essence of each and every portion of this contract and of the specifications wherein a definite and certain length of time is fixed for the performance of any act whatsoever; and where under the Contract an additional time is allowed for the completion of any Work. The new time limit fixed by such extension shall be of the essence of this Contract.
- 8.4.6 If job progress has been adversely affected by the non-attendance of the Contractor, or subcontractor at a scheduled job meeting of which he has been duly notified, such adverse effect shall be considered as job delay and the Contractor shall be subject to payment of damages to the University in an amount not to exceed \$100 for each occurrence.
- 8.4.7 The Contractor shall not be charged with liquidated damages, or any excess cost when the Owner determines that the Contractor is without fault and the Contractor's reasons for the time extension are acceptable to the Owner; provided further, that the Contractor's delay in the completion of the Work is due:
- a. To any preference, priority or allocation order duly issued by the Government.

- b. To unforeseeable cause beyond the control and without the fault or negligence of the Contractor, including, but not restricted to, acts of God, or of the public enemy, acts of the University, acts of another Contractor in the performance of the Contract with the University which acts are contrary to the terms of such Contract, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes and severe weather; and
- c. To any delays of Subcontractors or suppliers occasioned by any of the causes specified in subsections (a) and (b) of this article.
- d. The Contractor shall, within five (5) days from the beginning of such delay, unless the Contracting Officer shall grant a further period of time prior to the date of final settlement of the Contract, notify the University in writing of the causes of the delay. The Contracting Officer shall first ascertain the facts and the extent of the delay and shall notify the Contractor within a reasonable time that good cause has been shown to warrant the granting of such extension.

8.5 NO DAMAGE FOR DELAY

8.5.1 The University shall have the right to defer the beginning or to suspend the whole or any part of the Work herein contracted to be done whenever, in the opinion of the Contracting Officer, it may be necessary or expedient for the University to do so. If the Contractor is delayed in the completion of the Work by act, neglect or default of the University, of the A/ E, or of any other Contractors employed by the University upon the Work, or by change orders, strikes, lockouts, fire, unusual delay by common carriers, unavoidable casualties, or any cause beyond the Contractor's control, or by any cause which the Contracting Officer shall decide to justify the delay, then for all such delays and suspensions the Contractor shall be allowed one day additional to the time herein stated for each and every day of such delay so caused in the completion of the Work, as specified in Article 8.6, the same to be determined by the Contracting Officer and a similar allowance of extra time will be made for such other delays as the Contracting Officer may find to have been caused by the University. No such extension shall be made for any one or more of such delays unless within ten (10) days after the beginning of such delay a written request for additional time shall be filed with the Contracting Officer. Apart from extension of time, no payment or allowance of any kind shall be made to the Contractor as compensation for damages on account of hindrance or delay from any cause in the progress of the Work, whether such delay be avoidable or unavoidable.

8.5.2 The Contractor shall not be entitled to any damages or extra compensation from the University on account of any Work performed by the University or any other Contractor or the A/ E or any other party, or

by reason of any delays whatsoever, whether caused by the University or any other party, including but not limited to the delays mentioned in this Contract.

8.6 INDEMNIFICATION

8.6.1 The Contractor shall assume all risk of and any responsibility for, and agrees to indemnify, defend and save harmless the University and its employees, the Construction Manager and its employees, the Architect/ Engineer and its employees from and against, any and all claims, demands, suits, actions, recoveries, judgment and costs and expenses in connection therewith on account of the loss of life, property or injury or damage to the person, body or property or any person or persons whatsoever, resulting from the performance of the Project or through the negligence of the Contractor, or through any improper or defective machinery, implements or appliances used by the Contractor in the project, or through any act or omission on the part of the Contractor or their agents, employees or servants, which shall arise from, or result directly, or indirectly from the Work and/ or materials supplied under this contract. This indemnification obligation is not limited by, but is in addition to, the insurance obligations contained in this agreement.

8.6.2 In any and all claims against the University, the A/ E, any of their agents or employees, by any Contractor, sub-contractors, their employees, anyone indirectly employed by them, or anyone for whose acts any of them may be liable, the indemnification obligation under this Section shall not be limited in any way as to the amount or type of damages, compensation or benefits payable by or for the Contractor or any Subcontractor under Worker's or Workman's Compensations Acts, Disability Benefits Acts, or other Employee Benefit Acts.

8.7 CONTRACT TIME - NOTICE TO PROCEED

8.7.1 Contract time shall commence on the date as stipulated in the written Notice to Proceed, issued by the University. Notice to proceed shall be promptly issued after receipt and acceptance of properly executed contract documents including Performance and Payment Bonds and approved project schedule as described in 9.2. The Contractor agrees that contract site work shall commence no later than ten (10) calendar days after receipt of the Notice to Proceed.

8.7.2 If in the opinion of the University, the Contractor's delay in furnishing financial responsibility and Performance or Payment Bonds cause a delay in the issuance of Notice to Proceed, the time to complete the Work as specified in the Contract may be reduced to reflect such delay.

8.7.3 The Contractor shall perform no Work under this contract until the required evidence of financial responsibility and bonds have been

furnished. Thereafter, Work at other than the contract site may be undertaken. The Contractor shall perform no Work at the contract site except pursuant to a Notice to Proceed.

END OF ARTICLE 8

## ARTICLE 9

### CONSTRUCTION PROGRESS

#### 9.1 PROGRESS MEETINGS

9.1.1 Progress meetings will be held every two weeks, at the job site and at a time mutually agreed upon. The Contractor and Subcontractors concerned with scheduling of future progress, and the A/ E, shall each be represented by persons familiar with the detail of the Work and authorized to conclude matters relative to Work progress, schedules, etc. The Contractor and Subcontractors attending these meetings shall present complete and definitive status reports of their respective Work. They will also provide data relative to the availability of products, equipment's, labor, shipping data, time of completion and sequences of the Work and other information bearing upon the execution of the Work.

9.1.2 The Owner, CM and the A/ E will attend the meetings. The CM will chair and prepare accurate minutes, and will reproduce and promptly distribute same.

#### 9.2 GENERAL SCHEDULE REQUIREMENTS

The Contractor shall schedule the construction work and determine the most feasible means and order for the work to complete the project within the times required by the contract. The Contractor shall prepare a project schedule and monthly schedule updates which must be approved by the University and the architect, and it shall perform the contract and the work in accordance with the schedule. The project schedule must be submitted before the contract is signed, and must be approved before any work on the project can begin under the notice to proceed. When the Contractor's schedule is approved by the University, it shall become an additional contract document and the Contractor shall be required by the contract to comply with it. The project schedule and updates shall be used in determining the amount of the monthly progress payments to the Contractor. The University may also use the schedule and updates to determine if the Contractor is adequately planning and performing the work in accordance with the contract.

#### 9.2.1 Form and Content of Schedule

The Contractor shall prepare the project schedule using Critical Path Method (CPM) scheduling techniques. The Contractor shall utilize the latest revision of Primavera P3 Scheduling software. The Contractor shall prepare a detailed schedule, which shows how it will plan, organize, execute and complete the work. The schedule shall be in the form of an activity oriented network diagram (CPM). The principles and definitions used in this section shall be as set forth in the Associated General Contractors of America (AGC) publication "Construction Planning and Scheduling", copyright 1994.



The detailed network diagram shall provide sufficient detail and clarity of form and technique so that the Contractor can plan, schedule and control its work properly, and the University and the architect can readily monitor and follow the progress of all portions of the work. The network diagram shall comply with the limitations imposed by the scope of the work and contractually specified milestone dates and completion dates. The CPM schedule shall include the arrow or network diagram and the computer produced schedule with dates.

The schedule shall include and reflect the following factors:

1. Project phasing, and contract milestones and completion dates.
2. The structural breakdown of the project.
3. The types of work to be performed and the labor trades involved.
4. Reasonable logic and activity durations.
5. Reasonable coordination of all activities.
6. Purchase, manufacture and delivery activities for all major materials and equipment.
7. Deliveries of University furnished equipment.
8. Allowances for work by separate contractors identified in writing by the University at the time of contract award.
9. Submittals and approvals of shop drawings, material samples, and other required submittals.
10. Subcontract work.
11. Crew flows and sizes (manpower).
12. Assignment of responsibility for performing all activities.
13. Access and availability to work areas.
14. Identification of interfaces and dependencies with preceding, concurrent and follow-on contractors, and sequences and interdependence of activities.
15. Testing.
16. Phased or total inspection, acceptance, and takeover by the University.
17. Utilization of schedule to determine amounts of monthly progress payments.
18. Activities required of the University and the project architect such as approvals, including reasonable durations for the activities.

Activities should be set forth in working days and have a maximum duration of 10 days, except for non-construction activities such as the procurement and delivery of materials and equipment. All durations shall be the result of definitive manpower and resource planning by the Contractor. The level of detail in the schedule shall be subject to the approval of the University. The schedule shall include a reasonable approach to achieve milestones and completion dates in the contract. Any failure of the Contractor to include any element of the work in the schedule shall not excuse the Contractor from completing that work and all of the work needed to complete the project by the completion dates in the contract.

The network diagram can either be hand drawn or prepared by a computer plotter. The logic diagram will be pure logic and shall not be drawn to time scale. The logic diagram shall be drawn on 30" x 42" size sheets and prepared on a tracing/ Mylar or similar material suitable for reproducing high quality prints.

#### 9.2.2 Computerization of Schedule.

The mathematical analysis of the detailed network diagram shall be made by computer, and the tabulation for each activity shall include the following:

1. Activity numbers.
2. Activity descriptions.
3. Durations in workdays for each activity.
4. Earliest start date (by calendar date).
5. Earliest finish date (by calendar date).
6. Latest start date (by calendar date).
7. Latest finish date (by calendar date).
8. Slack or total float in workdays.

The following computer documents shall be prepared as part of the initial schedule submission and each update:

1. Activity file sort, including sorts listing activities required of the University and the project architect, such as approvals.
2. Eight week "Look ahead" detailed bar chart.
3. Eight week summary bar chart.
4. Additional computer sorts requested by the University.
5. High-density floppy disks or CDs of all computer files.

#### 9.2.3 Weather Inclusion in Schedule

Seasonal weather conditions shall be included in the schedule, including average precipitation, temperature and other weather conditions typical in the geographic area over a 5-year period by quarterly period (spring, summer, fall, winter).

#### 9.2.4 Schedule Updates

The Contractor shall prepare schedule updates monthly until its contract and the project are completed. The first update shall be issued 30 calendar days after the construction start date specified in the notice to proceed. Updates shall include the following information:

1. Actual start and completion dates for activities.
2. Activity percent completion.

3. Remaining durations for activities in progress.

Each schedule update shall also include a narrative report, which includes the following information:

1. Summary of work completed during update period.
2. Comparison of actual progress and status to activities and dates in original schedule.
3. Analysis of critical path including affect of activity progress on critical path.
4. Analysis of secondary critical paths, meaning float within 10 days of the project critical path.
5. Analysis of time lost or gained during the update period.
6. Identification of problem areas.
7. Identification of change orders and delays impacting or delaying the project under the project schedule.
8. Solutions or proposed solutions to current problems and delays.
9. Extensions requested by the Contractor, including activities affected and the amounts, and the reasons for the requests.
10. Extensions granted by the University for delays and changes, including the activities affected and the amounts, and any effect on the critical path and contract completion dates.
11. Delays in activities required of the University and the project architect, and activities which they are required to complete in the update period following the issuance of the update.

All schedule updates must be submitted to the University and the architect for approval. Schedule updates including the reports which are approved by the University shall be deemed to be official records of the progress and status of the project under the schedule and the contract, and may be utilized by the University in determining if the Contractor is adequately planning and performing the work under contract.

#### 9.2.5 Monthly Progress and Scheduling Meetings/ Eight Week Bar Charts

The Contractor's project manager and scheduler shall arrange for and attend monthly progress and scheduling meetings with the University and the project architect. Monthly progress meetings shall be scheduled 3 to 7 days after monthly schedule updates and reports are issued and provided to the University and the project architect. The purpose of these meetings will be to review past progress, current status, problem areas, delays, measures to reduce delays, future progress, and the Contractor's most recent schedule update and report. At the monthly progress meetings, the Contractor shall provide look ahead summary and detailed bar charts showing the work and activities to be performed and/ or completed during the eight-week period following the schedule update.

#### 9.2.6 Schedule Documentation for Contract Payments

The Contractor will not be entitled to payments under the contract until a project schedule has been submitted to and approved by the University. No payment will be made under the contract if when the payment is due, a schedule update and narrative report is due under this paragraph but has not been submitted to and approved by the University. The original CPM project schedule shall include a breakdown allocating the total contract price among the network activities in the schedule, which must be approved by the University.

#### 9.2.7 Progress, and Recovery Schedules

The Contractor shall perform its work in accordance with the schedule. If the Contractor's work falls behind the requirements of the schedule, it shall at its own cost institute measures to improve its progress and bring its work in compliance with the schedule, including but not limited to increasing manpower, increasing work hours per shift, increasing shifts, increasing working days per week, and re-scheduling work activities to perform them concurrently where feasible.

If monthly schedule updates show that the Contractor's progress has fallen behind the project schedule so as to jeopardize the achievement of milestone or completion dates in the contract by more than 10 work days, the Contractor shall, if requested by the University in writing, prepare a recovery schedule with acceleration measures to regain the lost time, and shall proceed in accordance with the recovery schedule in addition to the project schedule at its own cost.

#### 9.2.8 Contractor Failure to Provide Schedule Updates

If the Contractor fails to provide monthly schedule updates and reports when required, the University can elect in its sole discretion to employ any of the following remedies: 1) not make progress payments; 2) on 5 days written notice to the Contractor, retain its own consultant to provide schedule updates and reports and deduct the cost from the contract price; 3) terminate the contract for default in accordance with the termination provision in these general conditions.

#### 9.2.9 Scheduler Qualifications

The Contractor must utilize a scheduler, which satisfies the qualification requirements in the University's Bidder Qualification Statement for the project. If at any time during the project it appears that the Contractor's scheduler is not competent to provide the scheduling services required in this article, the Contractor shall within 5 days after a written notice and demand from the University, retain a replacement scheduler, which is competent to provide the services required. The University may also utilize any of the remedies in this article and the contract and general conditions for the Contractor's failure to provide proper schedule updates and reports.

### 9.3 EXTENSIONS, COMPENSATION FOR CERTAIN EXTENSIONS

#### 9.3.1 Delays Warranting Extensions of Contract Dates

If the Contractor is unavoidably prevented from completing any part of the work within the milestone, substantial completion or final completion dates in the contract by causes beyond the control and without the fault of the Contractor or its subcontractors, those contract dates will be extended by amounts equal to the time lost due to such delays, provided the Contractor requests extensions in accordance with this article. Delays warranting extensions of the contract dates include unforeseeable and unavoidable delays caused by the University, the project architect, other contractors employed by the University, utility owners or other third parties, acts of God, acts of governmental authorities, wars, abnormal weather conditions, fires, floods, earthquakes, epidemics, plagues, and other unavoidable casualties.

#### 9.3.2 Weather Delays

No time extensions will be granted for time lost due to normal seasonal weather conditions. To qualify for a time extension due to unusually severe or abnormal weather conditions, the Contractor must demonstrate that the weather conditions during a given quarterly period (summer, fall, winter, spring) were more severe at the project site than the previous five year average for the geographic area by quarter, and that the weather conditions critically impacted contract milestone, substantial completion or final completion dates by delaying the performance of work on the project's critical path. No time extensions will be considered for any weather conditions that do not affect work on the critical path or contract dates.

#### 9.3.3 Float Time Use

Float time in the schedule is not for the exclusive use of either the Contractor or the University. Float time is available for use by both parties to facilitate the effective use of available resources and to minimize the impact of problems and delays, which may arise during construction. No time extension will be granted as a result of any problem, change order or delay which only results in the loss of available positive float on the project schedule. Float time shown on the project schedule shall not be used by the Contractor in a manner, which is detrimental to the interests of the University or the project.

#### 9.3.4 Calculation of Extensions

Extensions will be calculated based on the effect of delays on the project schedule and the activities in the schedule. If the Contractor is entitled to an extension for a delay based on the nature of the delay under this article, the activities in the

schedule affected by the delay will be extended by the amount they are affected. If extensions of activities in the project schedule affect the critical path and delay the contract milestone and completion dates, they too will be extended to the extent affected. The critical path and contract dates will only be extended to the extent that they are actually affected under the schedule by a delay for which the Contractor is entitled to an extension.

If for any scheduled activity or period there are concurrent delays which include delays for which the Contractor is entitled to an extension and delays for which the Contractor is not entitled to an extension, the Contractor will be given an extension for the delays for which it is entitled to extension so that it will not be liable to pay liquidated damages for delay, unless the University eliminates or reduces that delay.

#### 9.3.5 Elimination of Delays and Extensions (Acceleration)

The Contracting Officer may order and direct the Contractor to accelerate the Work at any particular place or places by increasing their forces, Working overtime and/ or on Saturday, Sundays and holidays as may be required to carry on with the Work in accordance with the Progress Schedule. If a delay for which the Contractor is entitled to an extension can be reduced or eliminated by changes in the schedule or other measures which have no material adverse impact on the Contractor in terms of cost or otherwise, the Contractor shall employ those measures so that no extension is required or so that a shorter extension is required. If the Contractor is entitled to extensions for delays, and if the University (in its sole discretion) notifies the Contractor in writing that it prefers to eliminate the lost time to avoid or reduce the extension required, by changes or additional efforts such as acceleration efforts, the Contractor shall perform those measures as a change to the contract to be compensated under the change order provisions of the contract and the general conditions.

#### 9.3.6 Requests for Extensions Required

The Contractor must provide the University with a written notice of delay and request for an extension within 5 days of the beginning of a delay, or it will not be entitled to an extension. The written notices of delay and requests for extensions must include the nature and cause of the delay, the known extent of the delay, the work activities on the project schedule affected by the delay and the extent of the affect to each, and suggestions or proposals to reduce or eliminate the delay.

#### 9.3.7 Compensation for Certain Extensions and Limitations

Under the contract and general conditions, the University does not assume responsibility for many types of delays, including additional costs resulting from extensions granted because of those delays. Where the University is responsible

for a delay under the express terms of the contract and general conditions, it will pay extra compensation for any extension granted because of the delay.

Compensation by the University for delays (and extensions) for which it is responsible under the contract and general conditions shall only include additional costs actually incurred at the site, and shall not include home office expense, home office overhead, lost profit or consequential losses. Any additional compensation under this paragraph shall be subject to the provisions in the contract and general conditions regarding claims, and the provisions in the contract and general conditions regarding the maintenance and availability of cost records.

No compensation will be paid if an extension for a delay for which University is responsible is concurrent with another delay for which the Contractor is not entitled to an extension, or is concurrent with another delay, which the Contractor is entitled to an extension but the University is not responsible for the other delay.

If the University requests a change in the contract work, potential delays and extensions which result from the change and any resulting extra compensation for the change shall be addressed under the change order provisions in the contract and the general conditions in addition to this article.

END OF ARTICLE 9

## ARTICLE 10

### PAYMENTS

#### 10.1 PAYMENTS TO CONTRACTOR (NO CPM)

- 10.1.1 The University shall pay the Contractor the contract price as approved. Contractor to submit monthly requisitions (five complete sets) using University approved form.
- 10.1.2 The University may make progress payments monthly as the Work proceeds. Unless otherwise directed, the Contractor shall furnish monthly updated Progress Schedule, Schedule of Amounts for Payments showing the amount for each category of the Work in sufficient detail to provide a basis for determining progress payments. The progress schedule, as approved, shall be used only as a basis for the Contractor's estimates for progress payments and approval by the University does not constitute acceptance of the allocatability and allow ability of costs to a specific element of Work. The Contractor is cautioned that no payment requests shall be approved until the Unit Schedule Breakdown has been approved in writing.
- 10.1.3 The University at its discretion, may authorize material delivered on the site and preparatory Work done to be included in the payment requests. Material delivered to the Contractor at locations, other than the site, may also be taken into consideration, if the Contractor furnishes forms entitled "Prime Contractors Summary of Stored Materials", and "Agreement and Bill of Sale Certification for Stored Materials", respectively.
- 10.1.4 Making such progress payments for Work the University will retain 10% of the approved Requisition for Payment until final acceptance and completion of all Work covered by the Contract, except; after fifty percent (50%) of the Work has been completed and upon application by the Contractor, provided the University determines that the performance and progress have been satisfactory, the partial payments thereafter may be made in full. If, however, progress is not maintained in accordance with the approved schedule, the University may elect to re-institute the 10% retainage. Upon acceptance and completion of each building or other clearly definable severable portion of the Contract Work for which the price is stated separately within the Contract, payment may be made in full at the discretion of the University, including retained percentages thereon, less authorized deductions. All material and Work covered by progress payments made shall thereupon become the sole property of the University but their provision shall not be construed as relieving the Contractor from the sole responsibility for all material and Work upon which payments have been made or the restoration of any damaged Work, or as waiving the right of the University to require the fulfillment of all of the terms and conditions of the Contract.



- 10.1.5 When Performance or Payment Bonds are required, the University shall pay to the Contractor the total premiums paid by the Contractor to obtain the bonds. Their payment shall be paid at one time to the Contractor together with the first progress payment otherwise due after the Contractor has (1) furnished the bonds (including coinsurance and reinsurance agreements, when applicable), (2) furnished evidence of full payment to the surety company, and (3) submitted a request for such payment. The payment of the bond premiums to the Contractor shall not be made as increments of the individual progress payments and shall not be in addition to the contract price.
- 10.1.6 Upon completion and acceptance of all Work, the amount due the Contractor under their contract shall be paid upon satisfactory completion, of all contract closeout requirements, completion of an audit on all contract values and payments, and after the Contractor shall have provided a release of claims against the University, arising by virtue of their contract, other than claims in stated amounts as may be specifically excepted by the Contractor from the release.
- 10.1.7 Upon satisfying the above conditions the Contractor shall submit a properly executed invoice for final payment.
- 10.1.8 If, for any reason, the Contractor refuses final payment, the project shall be closed out by processing a Final Acceptance Certificate. All residual funds will be held in escrow until all claims and all Contractors are satisfied.
- 10.1.9 In addition to other warranties required by provisions of the Contract and Specifications, the Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the University, either upon incorporation into the construction or upon receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances. Their provision shall not be construed as relieving the Contractor from sole responsibility for the care and protection of materials and Work upon which payments have been made, or the restoration of any damaged Work, or as a waiver by the University of its rights to require fulfillment of all terms of the Contract.
- 10.1.10 Recommendation for Approval of a Requisition for Payment will constitute a representation by the A/E and the CM, based on their inspections at the site and data contained in the Requisition for Payment, that the Work has progressed to the point indicated; that, to the best of their knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents; and that the Contractor is entitled to payment in the amount certified. By recommending approval of requisition for payment, however, the A/E shall not thereby be

deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examinations to ascertain how and for what purpose the Contractor has used the monies previously paid on account of the Contract Sum.

10.1.11 If any contractor doing business in New Jersey shall be or become delinquent, in the payment of taxes due the State, unless under an active appeal process, the University may withhold monies due the said contractor for the purpose of assuring the payment to the State of such taxes.

10.2 INVOICES

10.2.1 An invoice is a written request for payment under the Contract for supplies delivered, or for service rendered. The invoice must be submitted on the form provided by the University and in accordance with the instructions pertaining thereto.

10.2.2 All information or documentation required by the provisions of the Contract shall be provided.

10.2.3 Invoices shall be prepared and submitted in original plus four copies, unless otherwise specified.

10.2.4 Technical data such as "AS-BUILT" Drawings, reports, spare parts lists, repair parts lists, or the like, or instructions books (including operational and maintenance manuals), or any part thereof which are not delivered within the time specified by their contract or are deficient upon delivery, the University shall at its discretion, withhold from each invoice a percentage (in addition to any other retainage required by the Contract) of the contract price in accordance with the following table:

<u>When total contract price is:</u>	<u>Percentage to be withheld is:</u>
Less than \$250,000	10%
\$250,000 to \$1,000,000	5%
Over \$1,000,000	2%

The withholding or any sums pursuant to their Article shall not be construed as, or constitute in any manner, a waiver of the Contractor's obligation to furnish the data required. In the event the Contractor fails to furnish these items, the University shall have those rights and remedies provided by law and pursuant to their contract in addition to, and not in lieu of, the sums withheld in accordance with their Article.

10.2.5 Those projects for which a CPM scheduling and cost control system is being used, the payment procedures stipulated in Article 9 will take

precedence. Where no conflict exists between Articles 9 and 10, the two articles are intended to apply in concert with one another.

END OF ARTICLE 10

## ARTICLE 11

### UNCOVERING AND CORRECTION OF WORK

#### 11.1 UNCOVERING OF WORK

11.1.1 If any portion of the Work is covered prior to inspection by the Contracting Officer, State of New Jersey Code Inspectors having jurisdiction or the A/ E, especially Work specifically required by the Contract Documents to be inspected, it shall be uncovered for observation. Uncovering and replacement of covering shall be at the Contractor's expense. The Contractor is obligated to advise the Contracting Officer or the A/ E of all Work scheduled to be covered which is reasonably subject to inspection before actual covering.

11.1.2 If any other portion of the Work (not specifically required to be inspected) has been covered, which the Contracting Officer, or the A/ E, did not make a request to observe prior to being covered, a request may subsequently be made to inspect such Work, and it shall be uncovered by the Contractor. If such Work is not in accordance with the Contract Documents, the Contractor shall pay all associated costs, unless it is found that this condition was caused by the University, in which event the Contracting Officer shall be responsible for the payment of such costs. If such Work is found to be in accordance with the Contract Documents, the cost of uncovering such Work shall be paid by the Contracting Officer through appropriate change orders.

#### 11.2 CORRECTION OF WORK

11.2.1 The Contractor shall promptly correct all Work rejected as defective, or as failing to conform to the Contract Documents, whether observed before or after Final Acceptance and whether or not fabricated, installed or completed. The Contractor shall bear all costs of correcting such rejected Work, including the A/ E's additional services, if any.

11.2.2 The Contractor shall remove from the site all portions of the Work which are defective or nonconforming and which have not been corrected unless removal is waived by the Contracting Officer.

11.2.3 If the Contractor fails to correct defective or non-conforming Work, in a timely manner, the Contracting Officer may make arrangements for such correction by others and charge the cost of so doing to the responsible Contractor and/ or their Sureties.

11.2.4 If the Contractor does not proceed with the correction of such defective or nonconforming Work within a reasonable time, fixed by written notice from the Contracting Officer, or the A/ E, the Contracting Officer may remove and store the materials or equipment at the expense of the

Contractor. If the Contractor does not pay for the cost of such removal and storage within ten (10) days thereafter, the Contracting Officer may upon ten (10) days additional written notice sell such materials and equipment at auction or at private sale and shall account for the net proceeds thereof, after deducting all of the costs which are the responsibility of the Contractor, including compensation for the A/ E's additional services, if any. If such proceeds of sale do not cover all costs, which the Contractor should have borne, the difference shall be charged to the Contractor and an appropriate credit Change Order shall be issued. If the payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor and/ or their Surety shall pay the difference to the University.

11.2.5 The Contractor shall also be responsible for the cost of making good all Work destroyed or damaged by such correction or removal.

11.2.6 Nothing contained herein shall be construed to establish a period of limitation with respect to any other obligation, which the Contractor might have under the Contract Document.

11.3 ACCEPTANCE OF DEFECTIVE OR NONCONFORMING WORK

11.3.1 If the Contracting Officer determines that the best interests of the University will be served by accepting defective or nonconforming Work, he may do so instead of requiring its removal and correction. In such instances credit Change Orders will be issued to reflect an appropriate and equitable reduction in the Contract Sum. Such adjustment shall be effected regardless of Final Payment having been previously made, and the Contractor and/ or their Surety shall be responsible for promptly providing any funds due the University as a result thereof.

END OF ARTICLE 11

ARTICLE 12  
PROTECTION OF PERSONS AND PROPERTY

12.1            SAFETY PRECAUTIONS AND PROGRAMS

12.1.1        Each Contractor shall be responsible, in cooperation with and under the leadership of the General Contractor, for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. They shall designate a responsible member of their organization at the Site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent, unless otherwise designated by the Contractor, in writing, to the Owner and the A/ E.

12.1.2        In order to protect the lives and health of their employees, the Contractor shall comply with all applicable statutes and pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc. and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from Work, arising out of and in the course of employ on the Work under the Contract. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of the plant, appliances and methods, and for any damage or injury, which may result from their failure, or their improper condition.

12.2            SAFETY OF PERSONS AND PROPERTY

12.2.1        Each Contractor shall take all reasonable precautions for the safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

- a.        Every employee on the Work and all other persons who may be affected thereby.
- b.        The Work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of their Subcontractors or Sub-subcontractors.
- c.        Other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

12.2.2        Each Contractor shall give all notices and comply with all applicable laws, ordinances, rules, regulations and lawful orders of any public authority bearing on the safety of persons or property or their protection from damage, injury or loss.

- 12.2.3 Each Contractor shall erect and maintain, as required by existing conditions and progress of the Work, all reasonable safeguards for safety and protection, including rails, night-lights, the posting of danger signs and other warnings against hazards, promulgating safety regulations, notifying owners and users of adjacent utilities and other means of protection against accidental injury, or damage to persons and property.
- 12.2.4 When the use or storage of explosives or other hazardous materials or equipment is necessary for the execution of the Work, the Contractor shall exercise the utmost care and shall carry on such activities under the supervision of properly qualified personnel. The storage of explosives or hazardous material must be authorized by the University prior to its being brought to the job site or any University property.
- 12.2.5 No Contractor shall load or permit any part of the Work to be loaded so as to endanger its safety.
- 12.2.6 Each Contractor shall promptly remedy all damage or loss to any property caused in whole or in part by him, any of their Subcontractors, Sub-subcontractors, or anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable and for which the Contractor is responsible, except damage or loss attributable to the acts or omissions of the Owner or A/ E, or anyone directly or indirectly employed by either of them or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to their obligations stated elsewhere herein.
- 12.2.7 Each Contractor is responsible for establishing and maintaining the OSHA job-site hazardous material log.
- 12.2.8 Each Contractor shall provide and maintain, in good operating condition, suitable and adequate fire protection equipment and services, and shall comply with all reasonable recommendations regarding fire protection made by the representative of the fire insurance company carrying insurance on the Work, or by the fire chief, or fire marshal having jurisdiction. The area within the site limits and surrounding areas shall be kept orderly and clean, and all combustible and other rubbish shall be promptly removed from the site.
- 12.2.9 Each Contractor shall, at all times, protect excavations, trenches, buildings and materials, from rain water, ground water, back-up or leakage of sewers, drains and other piping, and from water of any other origin and shall remove promptly any accumulation of water. Each Contractor shall provide and operate all pumps, piping and other equipment necessary to this end.

12.2.10 The Contractor shall remove snow and ice, which might result in damage or delay.

12.2.11 All Contractors shall comply with the Federal Occupational Safety and Health Act of 1970 and all the rules and regulations promulgated hereunder and NJ Work and Community Right to Know Act. (PL1983 c NJSC 34.5 a-1, ET SEQ,)

12.3 EMERGENCIES

12.3.1 When emergencies affecting the safety of persons or property occur, each Contractor shall act with diligence, at their discretion, to prevent threatening injury, damage or loss. They shall immediately notify the Contracting Officer, through the A/ E, of the action taken and shall forthwith prepare and submit a detailed and documented request for any additional compensation or extension of time claimed on account of emergency Work.

12.3.2 Wherever the Contractor has taken no action, but has notified the Contracting Officer, or the A/ E, or wherever the Contracting Officer has otherwise been made aware of any emergency threatening injury to persons, or loss or damage to the Work, or to adjacent property, the Contractor shall act only as instructed or authorized by the Contracting Officer.

END OF ARTICLE 12



## ARTICLE 13

### INSURANCE AND INDEMNITY

#### 13.1 CONTRACTOR INSURANCE REQUIREMENTS

- 13.1.1 The Contractor shall secure and maintain in force for the term of the Contract, insurance coverage provided herein. All insurance coverage is subject to the approval of the University and shall be issued by an insurance company authorized to do business in the State of New Jersey and which maintains an A.M. Best rating of A-(VII) or better.

The Contractor shall provide the University with current Certificates of Insurance for all coverage and renewals thereof which must contain the provision that the insurance provided in the certificate shall not be canceled for any reason except after thirty (30) days written notice to the University. All insurance required herein shall contain a waiver of subrogation in favor of the University. All insurance required herein, except Workers' Compensation and Owners and Contractors Protective, shall name New Jersey City University, the State of New Jersey, the New Jersey Educational Facilities Authority, the Architect/Engineer and Construction Manager as additional insureds.

- 13.1.2 Commercial General Liability insurance written on an occurrence form including independent contractor liability, products/completed operations liability, contractual liability, covering but not limited to the liability assumed under the indemnification provisions of this contract. Coverage for bodily injury and property damage claims arising out of the professional acts of the general contractor and subcontractors shall also be included. The policy shall not include any endorsement that restricts or reduces coverage as provided by the ISO CG0001 form without the approval of the University. The minimum limits of liability shall not be less than a combined single limit of one million dollars (\$1,000,000) per occurrence, three million dollars (\$3,000,000) general aggregate, three million dollars (\$3,000,000) product/completed operations aggregate. A "per project endorsement" shall be included, so that the general aggregate limit applies separately to the project that is the subject of this contract.

- 13.1.3 Comprehensive Automobile Liability covering owned, non-owned, and hired vehicles. The limits of liability shall not be less than a combined single limit of one million dollars (\$1,000,000) per occurrence.

13.1.4 Worker's Compensation Insurance applicable to the laws of the State of New Jersey and other State or Federal jurisdiction required to protect the employees of the Contractor and any Subcontractor who will be engaged in the performance of this Contract. This insurance shall include Employers' Liability Protection with a limit of liability not less than one million dollars (\$1,000,000) bodily injury, each occurrence, one million dollars (\$1,000,000) disease, each employer, and one million dollars (\$1,000,000) disease, aggregate limit. Including the employer's liability insurance under the umbrella insurance can satisfy the limit requirements.

13.1.5 The Contractor shall obtain and maintain a separate Owners and Contractor's Protective Liability Insurance Policy for the same limits of liability as specified for the Commercial General Liability Insurance in the name of the University, the State of New Jersey and the New Jersey Educational Facilities Authority. The Architect/Engineer, and the Construction Manager are to be the named as additional insured. The policy shall be maintained in force for the term of the Project or one year, whichever is longer.

13.1.6 Excess Liability, umbrella insurance form, applying excess of primary to the commercial general liability, commercial automobile liability and employer's liability insurance shall be provided with minimum limits of twenty million dollars (\$20,000,000) per occurrence, twenty million dollars (\$20,000,000) general aggregate, and twenty million dollars (\$20,000,000) products/completed operations.

13.1.7 The contractor shall require all subcontractors to comply with all of the insurance requirements described above, excepting excess liability. The contractor shall be responsible for obtaining certificates of insurance for all coverage and renewals thereof for each subcontractor prior to the subcontractor's beginning work on the project. The contractor shall provide copies of all subcontractor certificates of insurance to the University upon request.

13.2 INSURANCE TO BE CARRIED BY NEW JERSEY CITY UNIVERSITY

13.2.1 The University shall provide insurance protection in the form of a Builders Risk Insurance Policy upon the structure for which the Work on this Contract is to be done. The structure will be insured for 100% of the insurable replacement value thereof including materials, owned by the University, in place or to be used as part of the permanent construction including surplus materials.

- 13.2.2 This insurance shall not protect against damage or loss to any of the Contractor's or Subcontractor's tools, equipment, scaffolding, staging towers or forms, Contractor's materials and sheds or other temporary structures erected for used by the Contractor or Subcontractors. It is understood that the Contractor will at their own expense, carry all insurance which may be required to provide the necessary protection against such loss or damage herein described which insurance shall contain a waiver of any right of subrogation against the University.
- 13.2.3 The Contractor shall assume the responsibility for the first five thousand dollars (\$5,000.00) of any builder's risk loss, regardless of fault.
- 13.2.4 The Contractor shall immediately notify the University, in writing and take any other appropriate steps as may be required under the standard Builder's Risk Insurance Policy in effect in the event of any loss. Prior to the acceptance of the building by the University, the Contractor shall, at the University's option, replace and repair the damaged Work as originally provided in the drawings and specifications at no additional compensation to that provided in the original contract.
- 13.2.5 All losses will be adjusted with, and payable to, the University.
- 13.2.6 The Contractor shall not include any cost for Builders Risk insurance premiums as described herein. However, this provision shall not relieve the Contractor from their obligation to complete, according to plans and specifications, the project covered by the contract, and the Contractor and their Surety shall be obligated to full performance of the Contractor's undertaking.

END OF ARTICLE 13

## ARTICLE 14

### CHANGES IN THE WORK

#### 14.1 CHANGE ORDER DEFINITION

14.1.1 A Change Order is a written order to the Contractor, signed by the Contracting Officer and the A/ E, issued after execution of the Contract, authorizing a Change in the Work, or an adjustment in the Contract Sum, or the Contract time. The Contract Sum and the Contract Time may be altered only by a Change Order. A Change Order signed by the Contractor and the Contracting Officer indicates an agreement, which shall serve to adjust the Contract Sum and/ or the Contract Time. A Change Order shall become a part of the Contract Documents only after it is fully executed by the Contractor and the Contracting Officer.

#### 14.2 CHANGE ORDER PROCEDURES

14.2.1 Contractors are required to initiate six (6) copies of each Change Order which shall be distributed as follows: Five (5) copies directly to the A/ E (labor and material breakdown and all pertinent backup must be attached), and one (1) information copy shall be directed to the University.

14.2.2 The University without invalidating the Contract may order Changes in the Work within the general scope of the Contract, consisting of additions, deletions or other revisions. The Contract Sum and Contract Time will be adjusted accordingly. All such Changes in the Work shall be validated by Change Order and shall be performed under the applicable conditions of the Contract Documents.

14.2.3 The cost or credit to the University resulting from a Change in the Work shall be determined for each separate Change in the manner determined by the Contracting Officer and may, but need not be, determined in one or more of the following ways:

- a. Unit prices as stated in the Contract Documents or subsequently agreed upon. The unit price only, is used to determine the cost of Work and shall not be subject to further Contractor's markup for overhead profit.
- b. Mutual acceptance of a lump sum, properly itemized and supported by sufficient substantiating data to permit evaluation such as; cost of materials and cost of delivery; cost of labor including Social Security; Old Age and Unemployment Insurance, and Fringe Benefits required by agreement or custom; Worker's or

Workman's Compensation Insurance; rental value of machinery and equipment, additional profit; and applicable additional Bond Premiums.

- c. All change requests more than \$5,000.00 will require unit breakdown prior to approval.
- d. Payments on a Time and Material Basis for Work so authorized and when performed by the Contractor shall include the cost for labor and materials as detailed in (b) above plus ten percent (10%) for overhead, five percent (5%) for profit and if applicable, actual cost of additional Bond Premium, not to exceed one percent (1%). Where such Work is to be performed by a Subcontractor, the Contractor may not mark up the price in excess of ten percent (10%) of the Subcontractor's price, plus actual cost of additional Bond Premium, not to exceed one percent (1%). Total payment hereunder shall not exceed the maximum (upset) price established at the time Work is authorized.
- e. Payment for Standby Time or Overtime shall include a markup of not more than a total of ten percent (10%) of the net labor cost to cover the Contractor's overhead, profit, plus Bond Premium and this limit shall apply whether or not a Subcontractor is involved. Any and all claims for standby time or overtime will be rejected unless previously authorized in writing and documented time sheets are verified and signed by the University's Contracting Officers. Should the Contracting Officer authorize premium time for Work which would otherwise be performed within the Contractor's Scope of Work and not required as a result of the Contractor's fault, additional payment will be made only for the premium portion of the labor cost, plus a total of ten percent (10%) for both overhead and profit, plus actual cost of bond premium, not to exceed one percent (1%).

14.2.4 "No Cost" Change Orders also may be processed to validate extensions of time or to record changes in materials or procedures.

14.2.5 Failure to agree with any of the methods set forth above, the Contractor, provided he receives a written order from the Contracting Officer, shall promptly proceed with the Work involved in order to avoid delays to the progress of the Work. The Contractor may then proceed with their request for a Contracting Officer's Hearing.

14.2.6 The Contracting Officer, at his discretion, may order a Contractor Notice to Proceed, even in the absence of a formal Change Order. Contractors shall submit a follow-up Change Order within twenty (20) days from the date of authorization to proceed with the Work. The cost of such Work shall than be evaluated by the Contracting Officer on the basis of the

reasonable expenditures and savings for those performing the Work, including, in the cases of an Increase in the Contract Sum, ten percent (10%) for overhead and ten percent (10%) for profit, plus actual cost of additional bond premium, not to exceed one percent (1%). In such case, the Contractor shall keep and present, in such form as the Contracting Officer may prescribe, an itemized accounting together with appropriate supporting data for inclusion in a Change Order. Unless otherwise provided in the Contract Documents costs shall be limited to the following: Pending such final determination of cost to the Owner, payments on account may be made on the A/ E's Certificate for Payment, without prejudice to the rights to the parties.

- a. Net cost of materials, including cost of delivery.
- b. Cost of labor, including Social Security, Old Age and Unemployment Insurance and Fringe Benefits required by agreement or custom.
- c. Worker's or Workman's Compensation Insurance.
- d. Rental value of machinery and equipment.
- e. Ten percent (10%) for overhead, plus five percent (5%) for profit.
- f. Actual cost to the Contractor of any Work performed by a Subcontractor plus ten percent (10%) (no additional overhead and profit to be added for the Contractor).
- g. Actual cost of bond premium, not to exceed one percent (1%).

14.2.7 The amount of credit to be allowed by the Contractor to the University for any deletion or change which results in a net decrease in the Contract Sum will be the amount of actual net cost substantiated by a bill-of-material and a breakdown of labor costs to which will be added one percent (1%) for Bond Premium, if applicable. Documented cancellation and/ or restocking changes, if any, may be included in the calculation of credit.

14.2.8 When both additions and credits covering related Work or substitutions are involved in any one change, the allowance of ten percent (10%) for overhead, five percent (5%) for profit and actual cost of additional bond, not to exceed one percent (1%) shall be on the basis of the net increase, if any, with respect to that change.

14.2.9 When similar materials are to be added and deleted on the same Change Order, the net difference in material quantities shall be determined before pricing and the addition of overhead and profit. Labor costs involved in

the same trade shall be treated in the same manner, i.e., the difference in labor hours shall be determined before pricing and the addition of overhead and profit.

14.2.10 When a Change Order submitted by a Contractor involves added Work performed by a Subcontractor, the latter shall submit an estimate to the Contractor on their own stationery, properly itemized for labor and materials and supported by sufficient substantiating data to permit evaluation to which may be added ten percent (10%) for profit and five percent (5%) for overhead. The Contractor will then be allowed to add ten percent (10%) and applicable Bond Premium not to exceed one percent (1%). Only one (1) Subcontractor's markup per trade will be permitted.

14.2.11 When a Change Order submitted by a Contractor involves deleted Work of a Subcontractor, the later shall submit an estimate to the Contractor on their own stationery, properly itemized for labor and materials and supported by sufficient substantiating data to permit evaluation, including documented cancellation and/or restocking charges, if any, to which the Contractor will add applicable Bond Premium to the credit Change Order.

14.2.12 If unit prices are stated in the Contract Documents or subsequently agreed upon and if the quantities originally contemplated are changed in a proposed Change Order that application of the agreed unit prices to the quantities of Work proposed will cause substantial inequity to the Owner or the Contractor, the applicable unit prices shall be equitably adjusted. Nothing herein shall, in any way, limit the Contracting Officer's ability to order certain of this Work to be performed on a Time and Material basis even if applicable unit prices have previously been included elsewhere in the Contract Documents.

END OF ARTICLE 14

ARTICLE 15

ASSIGNMENT OF ANTI-TRUST CLAIM(S)

15.1 ASSIGNMENT OF ANTI-TRUST CLAIM(S)

15.1.1 The Contractor recognizes that in actual economic practice, overcharges resulting from antitrust violations are, in fact, usually borne by the ultimate purchaser. Therefore, and as consideration for executing this contract, the Contractor, acting herein by and through its duly authorized agent, hereby conveys, sells assigns, and transfers to the University, for itself, all right, title and interest to all claims and causes of action it may now or hereafter acquire under the antitrust laws of the United States or the State of New Jersey, relating to the particular goods or services purchased or acquired by the University pursuant to this Contract. The following are the express obligations of the Contractor:

- a. They will take no action, which will in any way diminish the value of the rights conveyed or assigned hereunder.
- b. They will advise the Attorney General of the State of New Jersey:
  - (1) Their intention to commence any action on their behalf regarding such claim or cause(s) of action.
  - (2) Immediately, upon becoming aware of the fact that an action has been commenced on their behalf by some other person(s), or the tendency of such action.
- c. They will notify the defendants in any antitrust suit of the fact of the within assignment at the earliest practicable opportunity after the Contractor has initiated an action on its behalf or becomes aware that such an action has been filed on their behalf by any other person. A copy of such notice will be sent to the Attorney General of the State of New Jersey.

Furthermore, it is understood and agreed that in the event any payment under any such claim or cause of action is made to the Contractor, it shall promptly pay over to the University the aliquot share thereof, if any, assigned to the University hereunder.

END OF ARTICLE 15



## ARTICLE 16

### AFFIRMATIVE ACTION REQUIREMENTS

#### 16.1 POLICY STATEMENT

- 16.1.1 It has long been the policy of the University to promote equal employment opportunity by prohibiting discrimination in employment and requiring affirmative action in performance of contracts funded by the University. This policy has been reinforced and expanded by an act of the Legislature, i.e., New Jersey Public Law 1975, Chapter 127, provides that no public Works Contractor can be awarded, nor any monies paid, until the prospective Contractor has agreed to contract performance which complies with the approved Affirmative Action Plan. The law applies to each political subdivision and agency of the State and includes procurement and service contracts as well as construction contracts. This section was prepared to explain the affirmative action requirements and procedures for public agencies awarding contracts and for Contractors bidding on contracts. These regulations are designed to minimize administrative paperwork and delays.

#### 16.2 MANDATORY LANGUAGE

- 16.2.1 During the performance of this contract, the Contractor agrees to comply with the provisions of the mandatory language as attached to the Contract (Form of Agreement).

END OF ARTICLE 16

## **SECTION 00 70 10 – SUPPLEMENTAL GENERAL CONDITIONS**

### **PART 1 - GENERAL**

#### 1.1 SECTION INCLUDES

- A. New Jersey City University Supplemental General Conditions

#### 1.2 SUPPLEMENTAL GENERAL CONDITIONS

- A. Attached are the New Jersey City University contract supplemental general conditions (pages 1 through 32).

**- END OF SECTION 00 70 10 -**

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

To all bidders providing labor and materials necessary and required for construction of this project.

Supplemental General Conditions is issued for the purpose of amending, revising and clarifying certain requirements of the Contract Documents, such requirements are hereby made part of said Documents as though they were originally included (or excluded) as indicated herein. All bidders shall be guided accordingly.

- A. Contract Time shall be **per the milestone schedule issued**, commencing from such date so stipulated within the Notice to Proceed, which shall be issued in accordance with Section 8.7 (Contract Time-Notice to Proceed) of the General Conditions of the Contract.
- B. Recycling of Demolition, Waste and Spoil. Contractor and all Subcontractors shall comply with all University, local, county and State requirements concerning recycling of construction demolition, waste and spoil. The Contractor and Subcontractors shall provide the University copies of all delivery documentation which shall specify the destination and quantity/weight of material recycled. The Contractor and Subcontractors are advised to consult with the University Recycling Coordinator in these matters. The quantity/weight of recycled material shall be applied to the University's cumulative recycling program.

### C. CORRECTIONS AND/OR CHANGES TO THE GENERAL CONDITIONS

#### ARTICLE 1 – CONTRACT DOCUMENTS

- 1.1.1 Deleted in its entirety and replace with the following:  
Addendum: An Addendum is a document, issued by the Owner prior to the opening of bids which supplements, revises or modifies the documents furnished for bidding purposes.  
Bulletin: A Bulletin is a document issued by the Owner after contract award that modifies the contract documents.
  - 1.1.16 Add the following “e-mail,” to the last sentence after the word “fax,”
- Add Article 1.1.29 as follows:
- 1.1.29 Substantial Completion: Substantial completion shall be determined by the Architect, Owner and Construction Manager upon review of field activities. Substantial Completion shall be evaluated upon completion of all items of Work as described, detailed and shown in the Contract Documents. All work must be completed to the satisfaction of the, Owner, Architect/Engineer, DCA, and Construction Manager in addition to the Contractor submitting proper documentation indicating all inspections and required testing requirements have been satisfied, the site is in an orderly, safe and maintained condition, the building or facility is operational or capable of serving its intended use, and the contractor has removed his field office and storage trailers off site. Warranty and guarantee periods shall commence on the date established for Substantial Completion, not delivery or start-up date.
  - 1.2.5 Deleted in its entirety and replace with the following: The Owner will only supply pdf files of the contract documents to the contractor during the bidding phase. No hard copies will be supplied. The contractor will be responsible for printing contract documents as required.

## **SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS**

1.2.8 Delete in its entirety and replace with the following:  
The sequence of precedence pertaining to interpretation of Contract Documents is as follows:

- a. Executed Contract / Agreement
- b. Addendum(s)
- c. Special Conditions / Provisions
- d. Supplemental General Conditions
- e. Divisions 0 & 1
- f. General Conditions
- g. Technical Specifications
- h. Drawings, in following order of precedence:
  - (1) Notes on Drawings
  - (2) Large scale details
  - (3) Figured dimensions
  - (4) Scaled dimensions

Where there may be a conflict in the sequence of precedence pertaining to the interpretation of the Contract Documents, not resolvable by application of the provisions of this paragraph, then the more expensive labor, materials, or equipment shall be assumed to be required and shall be provided by the Contractor at no additional cost to the Owner.

### **ARTICLE 2 – CONTRACTING OFFICER**

Add Articles 2.7 and 2.8 as follows:

#### **2.7 CONTRACTING OFFICER’S RIGHT TO PERFORM WORK**

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within three calendar days after receipt of written notice from the Contracting Officer or its authorized representatives to commence and continue correction of such default or neglect with diligence and promptness, the Contracting Officer may, without prejudice to other remedies the Contracting Officer may have, correct such deficiencies. In such case, an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including University’s expenses and compensation for the Construction Manager’s and Architect’s and their respective consultants’ additional services made necessary by such default, neglect or failure. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the University. Should work be performed by the Contracting Officer under this article, the Contractor will have no cause to void any guarantee on materials or systems installed under this Contract.

#### **2.8 OWNERSHIP AND USE OF DOCUMENTS**

All Drawings, Specifications and copies thereof furnished by the Architect/Engineer are and shall remain the property of the University. They are reserved to this Project only and are not to be used on any other Project. Submission or distribution of Documents to meet official regulatory requirements, or for any other purposes in connection with the Project shall not be construed as derogation of the Architect/Engineer’s copyright or other reserved rights.

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

### ARTICLE 3 – ARCHITECT ENGINEER/CONSTRUCTION MANAGER/OWNER’S REPRESENTATIVE

#### 3.2 ADMINISTRATION OF THE CONTRACT

- 3.2.1 Delete this item entirely and replace with the following:  
New Jersey City University will be represented by an Owner’s Representative and its own internal staff. The Owner’s Representative will routinely conduct on-site observations, maintain logs of construction progress, approve Contractor’s requisition for payments subject to final approval by the University, conduct job meetings, act as liaison between the Owner, Architect/Engineer and the Contractor, prepare and submit reports, evaluate and process Change Order Requests, and be fully cognizant and be kept informed by the Contractor of every aspect of ongoing construction.
- 3.3.1 Delete the following “Director for Campus Planning and Development” and replace with “Associate Vice President for Facilities and Construction Management”
- 3.4.1 Line 12, delete the word “condemn” and replace with “reject”.
- Add the following section 3.4.1.1:  
“The Architects review and action upon the Contractor’s Submittals shall be for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.”
- 3.4.4 Add the following section 3.4.4.1:  
“Neither the authority of the Architect, the Construction Manager, nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect or the Construction Manager to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.”
- 3.4.5 Line 1, delete the word “inspect” and replace with “review”.
- 3.4.6 Line 1, deleted the word “inspections” and replace with “on-site visits”.  
Delete the following “The A/E” and replace with “The A/E and the CM”

Add Articles 3.6, 3.7 and 3.8 as follows:

#### 3.6 CONSTRUCTION MANAGER

The Construction Manager or “CM” has been engaged by the Owner to provide full administration of the project. He shall serve as the Owner’s representative and will act on behalf of the Owner in connection with matters as generally described herein.

#### 3.7 RESPONSIBILITY - STAFFING

- 3.7.1 The Construction Manager has the responsibility for being the overseer of all the Contractors and of the construction in accordance with the Contract Documents. In pursuance of these duties, the Construction Manager will have the right to recommend the denial or reduction of payment of the Contractor’s monthly requisitions and final payment should the Construction Manager have cause to be dissatisfied with the performance of the Contractor. The Owner has the authority to modify or reject the Construction Manager’s recommendation.
- 3.7.2 The Construction Manager and the Architect/Engineer will monitor the execution and progress of the Work and will immediately notify the Owner of any related problems.

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

3.7.3 The Construction Manager & Architect/Engineer shall be able to talk with all contractors including subcontractors on-site. All direction is to go through the contractor and not the subcontractors.

### 3.8 ADMINISTRATION OF THE CONTRACT

3.8.1 In addition to the duties specified elsewhere in the Contract Documents, the Construction Manager will provide administration of the Contract as hereinafter described.

3.8.2 The Construction Manager will be the Owner's representative during construction and until final payment to the Contractor is due. The Construction Manager will advise and consult with the Owner. All Contractor communications, both verbal and written, shall be made through the Construction Manager.

3.8.3 The Construction Manager concurrently with the Architect/Engineer will receive from the Contractor all submittals (shop drawings, product data and samples). See Division 1 section 01 33 00.

3.8.4 The Contractor shall permit the Construction Manager to inspect off-site materials make all proper provisions, including site visits (in and/ or out of state), at the Contractor's expense, for the A/E, Owner, and/or Construction Manager's inspections.

## ARTICLE 4 – THE CONTRACTOR

### 4.1 DEFINITION

4.1.1 Add the following: "Where ever the contract documents state "the responsible Contractor" or "All contractors" or "each contractor" or "General Construction Contractor" etc. this means "the Contractor" since this is a single prime project."

4.2.5 Delete the last sentence and replace with "The contractor shall provide the University/CM with a copy of their job specific safety programs to be implemented during the course of construction. This copy shall remain in the contractor's field office at all times."

### 4.3 NEW JERSEY PREVAILING WAGE ACT

Delete in its entirety and replace with the following:

4.3.1 Each Contractor or any Subcontractor shall comply with the New Jersey Prevailing Wage Act, N.J.S.A. 34:11-56.25 and all amendments thereto as this Act is hereby made a part of every Contract entered into on behalf of the University except those contracts which are not within the contemplation of the Act. Provisions of the Act include:

a. All workmen employed in the performances of every Contract in which the Contract Sum is in excess of \$2,000 and Work to which the University is a party, shall be paid not less than the Prevailing Wage Rate as designed by the Commissioner of the Department of Labor and Workforce Development or its duly authorized representative.

(1) Each Contractor and Subcontractor performing public work for the University who is subject to the provisions of the Prevailing Wage Act, shall post the Prevailing Wage Rates for each craft and classification involved as determined by the Commissioner,

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including the effective date of any changes thereof, in prominent and easily accessible places at the site of the work or at such place or places as are used by them to pay workmen their wages.

- (2) The Contractor's signature on the proposal is its guarantee that neither it, nor any Subcontractor, is currently listed by, or on record with, the Commissioner as one who has failed to pay the Prevailing Wages according to the Prevailing Wage Act.
  - b. In the event it is found that any workman, employed by any Contractor or any Subcontractor covered by any Contract in excess of \$2,000 for any public work to which the University is a party, has been paid a rate of wages less than the Prevailing Wage required to be paid by such Contract, the Contracting Officer of the University may terminate the Contractor's or Subcontractor's right to proceed with the work, or such part of the work as to which there has been a failure to pay required wages and may otherwise prosecute the work to completion.
  - c. Nothing contained in the Prevailing Wage Act shall prohibit the payment of more than the prevailing wage rate to any workman employed on a public works project.
- 4.3.2 Delete in its entirety and replace with the following: The contractor shall submit certified payrolls for their firm and all subcontractors with their application for payment. Certified payrolls shall be for that applications billing period. If they are not submitted for all work being invoiced for that payment then that payment shall not be processed until all paperwork is submitted.
- 4.3.3 Each Contractor and Subcontractor are to submit with their bids the wage rate breakdown for each trade and classification including allowable mark-ups per this contract. The submitted wage rate for each trade will be used for all change order work. The submitted wage rates are subject to negotiation should it be necessary and resubmitted if the rate increases during this project.
- 4.3.4 Prevailing wage rates can be found at [http://lwd.dol.state.nj.us/labor/forms\\_pdfs/lsse/ HUDSON.pdf](http://lwd.dol.state.nj.us/labor/forms_pdfs/lsse/ HUDSON.pdf).  
If needed, the successful contractor will be provided a copy.

Add Articles 4.5.5 and 4.5.6 as follows:

- 4.5.5 The Contractor shall be responsible for all costs related to additional design services, Owner supervision, testing, inspections, and fees for Work incorrectly installed which requires modification or corrective work.
- 4.5.6 In order to protect the lives and health of its employees, the Contractor shall comply with all applicable statutes and pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment on work under the Contract. The Contractor alone shall be responsible for the safety, efficiency, and adequacy of its plant, appliances and methods, and for any damage or injury which may result from its failure or its improper construction, maintenance or operation.

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### 4.6 CODES, LICENSES, PERMITS AND INSPECTIONS

4.6.1a. Delete the following "2003, 2000" and replace with "the codes noted on the plans"

4.6.2g. Delete the following "by an appropriate Finder of Fact,"

### 4.7 STORAGE, CLEANING AND FINAL CLEAN UP

4.7.3 Delete the following "At the completion of the work," and replace with the following "At the time of substantial completion,"

4.7.5 Delete in its entirety and replace with the following:

4.7.5 The Contractor's responsibilities in final clean up include:

- a. Removal of all debris and rubbish resulting from or relating to its work. Rubbish shall not be thrown from building openings above the ground floor unless contained within chutes;
- b. Removal of stains from glass and mirrors; wash and polish inside;
- c. Removal of marks, undesirable stains, fingerprints, other soil, dust or dirt from painted, decorated or stained woodwork, plaster or plasterboard, metal acoustic tile, ceilings, wall coverings, and equipment surfaces;
- d. Removal of spots, paint and soil from resilient, glaze and unglazed masonry and ceramic flooring and wall work;
- e. Removal of temporary floor protections, clean, wash or otherwise treat and/or polish, as directed, all finished floors;
- f. Vacuum all carpet areas, (Common areas are to be done daily);
- g. Cleanout all casework and wipe down countertop surfaces;
- h. Wipe down and mop interior in elevator(s) so it is free of finger prints and dust; (if elevator is allowed to be used this is to be done daily)
- i. Remove plastic and wipe down all light fixtures, receptacle and device cover plates;
- j. Polishing of all University furnished furniture;
- k. Clean metal surfaces, including elevators, doors and window frames and hardware, of oil stains, dust, dirt, paint and the like, polish where applicable and leave without fingerprints or blemishes;
- l. Wash down and clean exterior curtain wall metal and glazing;
- m. Wash down and clean roofing so to remove excess adhesive, dirt, and rust stains;
- n. Wash down of all exterior improvements including pavers, concrete, asphalt, benches, etc.; and



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- o. Restoration of all landscaping, roadway and walkways to pre-existing condition. Damage to trees and plantings shall be repaired in the next planting season, and such shall be guaranteed for one year from date of repair and/or replanting at no additional cost to the University.
- p. Upon completion of the work covered by the Contract, the Contractor shall leave the completed project ready for use without the need of further cleaning of any kind and with all work in new condition and perfect order. In addition, upon completion of the Work, the Contractor shall remove from the vicinity of the work and from the property owned or occupied by the State of New Jersey and New Jersey City University of all rubbish, unused materials, concrete forms and other materials belonging to it or used under its direction during construction or impairing the use of appearance of the property and shall restore such areas affected by the work to their original condition, and in the event of its failure to do so, the same shall be removed by the University at the expense of the Contractor, and its surety shall be liable therefore.

4.9.1 Delete the following "24" and replace with the following "96"

4.10 DRAWINGS, SPECIFICATIONS, SHOP DRAWINGS, AS-BUILT DRAWINGS.

4.10.4 Delete the following "Within two (2) weeks of the contract award" and replace with the following "Per specification sections 01 11 05 and 01 33 00"

Add the following Section 4.10.5.A.6:

### DELEGATED DESIGN:

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required Submittals, submit (3) three copies of a statement, signed and sealed by the responsible design professional licensed in the state the Project is located, for each product and system specifically assigned to Contractor to be designed or certified by a licensed 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.
  - 2. Submittal will be reviewed by the Architect and Engineer. Once the Submittal is approved, the Contractor shall receive a letter from the Architect stating that the Submittal meets the requirements of the Project. The Contractor shall then be responsible for submitting three (3) signed and sealed copies of the Submittal, with the Architect's Letter, to the NJ Department of Community Affairs, Trenton NJ, for final review and approval, prior to proceeding with the Work. The Contractor shall provide transmittal copies of this submission to the Construction Manager and the Architect for record purposes.

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Delete the following sections and refer to Division 1 section 01 33 00

4.10.5 L (Review Section)

4.10.5 S

Delete 4.10.5(U) in its entirety and replace with the following:

### U. COORDINATION DRAWINGS

1. Prior to installing service utilities or other piping, etc. through structural elements of the building, the Contractor shall prepare and submit, for approval of the Architect, accurate dimensioned Drawings indicating the positions and sizes of all sleeves and openings required to accommodate its work and installation of its piping, equipment, etc. and all with reference to the established dimensional grid of the Building. Such Drawings must be submitted in sufficient time to allow proper coordination with reinforcing steel Shop Drawings, openings in precast concrete members, and proper placing in the Field.
2. Before construction work commences and before submitting shop drawings for sleeves, piping, ductwork, etc., the Contractor shall require that the installers/subcontractors for all trades submit Coordination Drawings.
3. The Contractor shall manage the process so that each trade/subcontractor provides all required information in a timely manner. Coordination Drawings may be completed on a phased basis so as not to delay the overall project schedule. The CPM Schedule specified elsewhere shall be amended to include the submission of Coordination Drawings. The same shall demonstrate how the Contractor intends to integrate the submission of Coordination Drawings to suit the overall project schedule.
4. Coordination Drawings shall show the resolution of trade conflicts in congested areas prior to submission of shop drawings and actual installation. The Drawings shall coordinate the placement and location of ductwork, fittings, light fixtures, cable trays, fire alarm devices, sprinklers, air terminals, hangers, supports and other ceiling mounted items shown and specified with each other, and other building elements such as ceilings, structural work, case work, equipment, doors, manufacturer's recommended maintenance clearances, code required clearances and visibility sightlines (NEC, etc.), access doors and other contract work.
5. In public and occupied areas without scheduled finish ceilings, appearance is a major coordination factor. Reposition proposed locations of work after Coordination Drawing review. Provide adjustments to the exact size, location and offsets of ducts, pipes, and conduit to achieve reasonable appearance objectives. Provide these adjustments as part of the Contract or notify the Architect immediately as to why the adjustment cannot be made.
6. The medium and format of the Coordination Drawings shall be as follows:
  - (a) The Contractor shall use CADD software to create the Coordination Drawings.
  - (b) Each MEP Division trade shall be assigned a layer to create the detailing work of each section or division of the Specifications requiring coordination. The Contractor shall insure that the layer assigned to one trade cannot be modified by another trade, and that the final product clearly differentiates which trade is responsible for the respective information shown. The latter may occur through the use of colors or other distinct graphic methods.

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- (c) The final product shall be in the form drawings drawn at a scale not less than 3/8 inch per foot for the entire building. Mechanical and Electrical equipment rooms shall be drawn separately at a scale not less than 1/2 inch per foot and be submitted with the drawings of the entire building. At conflicts between the trades, provide details, elevations, sections or three dimensional views of similar or larger scale as may be required to provide a clear three dimensional resolution of the conflict.
7. The Coordination Drawings shall be prepared as follows:
- (a) The Contractor shall prepare the base floor plan(s) in the medium chosen.
  - (b) The HVAC trade installer shall prepare the first layer of the Coordination Drawings showing all ductwork, and all pertinent heating piping and equipment. This plan may be a copy of the required ductwork shop drawings.
  - (c) The Contractor shall provide electronic or transparent copies to all the other trades/subcontractors.
  - (d) The Plumbing, Fire Protection, Controls and other non electrical trades shall show all their piping, equipment, valves, fittings, devices, and other specified appurtenances.
  - (e) The Electrical, Fire Alarm, and other electrical trades shall show all systems and equipment, including transformers, panels, terminals, devices, detectors, lighting fixtures, cable trays, outlets, and conduits and raceways 1" or larger. Cable tray layout shall include appropriate clearances to motors, ballasts, and other sources of electromagnetic interference.
  - (f) The Contractor shall review the Drawings and indicate areas of Architectural, Equipment, Structural and other conflicts and obstacles and coordinate locations of rated and exterior walls to assure their continuity and closure as specified. The Contractor determines that all work can be installed without interference. In the case of unresolved interference, the Contractor shall notify the Architect. The Architect will then suggest to the Contractor as to how to revise the Drawings to eliminate interference. The Contractor shall then have the trade(s) revise their respective Drawings to eliminate interference.
  - (g) Fabrication and installation of work in a given bay or area shall not proceed until the Contractor has made all trades agree on the exact arrangements for each bay or area. If a given trade proceeds prior to resolving conflicts, then, if necessary, that trade shall change its work at no extra cost in order to permit the other trades to proceed with a coordinated installation. Coordination approval may be given by the Contractor for a bay or area only after site meetings involving all trades have occurred.
  - (h) In the event of conflict areas without ductwork, each respective trade in conflict shall prepare coordination drawings showing the suggested final arrangements for review.
8. Coordination Drawings are intended for use by the respective trades during construction and shall not be construed as replacing either the shop drawings specified in the technical specifications or Record Drawings.

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9. Submit Coordination Drawings for review in the same manner as specified for shop drawings. The Architect's review of Coordination Drawings shall not relieve the Contractor from his responsibilities for coordinating the work with the work of all trades involved on the Project. The Architect's review shall not authorize any extra cost, omission and/or deviation from the requirements of the Contract Documents. Any costs arising from errors and omissions in the Coordination Drawings shall be borne by the Contractor.
10. Provide three (3) hard copies and electronic files (Adobe .pdf and CADD) of the Final Coordination Drawing once all issues have been resolved. All copies shall become the property of the University.

4.10.5 V 4 M Change "(90) ninety" to "(60) sixty" see section 01 11 05 for additional information

### 4.12 MISCELLANEOUS DRAWINGS, CHARTS, AND OPERATING MANUALS

4.12.4 Delete in its entirety. See Division 1 section 01 70 00

### 4.13 OPENINGS – CHANNELS – CUTTING AND PATCHING

Delete entire section and replace with the below:

- 4.13.1 The Contractor shall build openings, as required to complete the Work as set forth in the Contract and as directed by the Owner before any work is installed. No gas powered equipment to be used in occupied buildings, near building intakes, and/or operable windows.
- 4.13.2 After the installation and completion of all work for which openings, have been provided for the Contractor, the Contractor shall build in, over, around and finish all such openings as required. If a Contractor fails to furnish drawings and information required in connection with such openings before the Contractor performs any Work affected thereby, said Contractor who so fails to furnish such Drawings and information shall bear the cost of all cutting and refinishing including that part of the Contractor's Work affected.
- 4.13.3 The Contractor shall furnish and install all lintels, relieving angles, sleeves, inserts, hangers and supports required for the execution of the Work.
- 4.13.4 Specific instructions shall be obtained from the Owner's Representative before cutting or boring through floor/roof beams or other structural members, arches, lintels, etc..
- 4.13.5 The Contractor shall not endanger the Work and shall not cut or alter the Work unless prior approval and instructions are received from Owner.
- 4.13.6 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.
- 4.13.7 The Contractor shall make new Work fit existing work and/or existing conditions at Contractor's cost and expense. Changes in the Work attributable to varying field and/or existing conditions which represent a minor difference from those indicated on the drawings or can be reasonably predicted or expected to be encountered shall be provided and accomplished at no cost to the University.

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- 4.13.8 Except as otherwise provided, Contractor shall do all cutting, drilling, removal, cleaning, servicing, repairing, reroofing, patching, re-hanging, and restoration that may be required in connection with the work. Contractor shall pay for the restoration of existing conditions and work of others damaged by his actions. Contractor shall be responsible for maintaining all existing warranties.
- 4.13.9 Replace, fit, patch and repair material and surfaces cut or damaged by methods and with materials required to restore surfaces to original conditions and in conformance with manufacturer's requirements in such a manner as not to void or compromise any warranties required or newly existing.
- 4.13.10 Prior to cutting and demolition work, the Contractor shall survey and locate utilities, structural elements and hazards using locator/detection equipment. Promptly submit a written report to the Architect describing the nature and extent of any conflicts with the intended function or design of the work. Do not proceed with work until such conflicts are resolved and areas surveyed.
- 4.13.11 All drilling and patching for expansion bolts, hangers and other supports shall be done only after approval of Architect/Engineer.

### 4.14 TESTS AND INSPECTIONS

- 4.14.1 Delete "The contractor shall bear" in the last sentence, and replace with "The Owner shall bear". Add the following: "The contractor is responsible and shall bear all costs for factory testing of equipment installed by them. **ALL** new equipment shall be factory tested with reports issued to CM whether or not it is stated in the technical specifications. The Contractor shall prepare all DCA permit applications, technical sections (one for each trade and/or contractor) and fill out the fee applications (the Owner will pay the DCA fees only) on an expedited basis to preclude any construction delays, if something is left off the technical sections and needs to be added the paperwork is to be filled out by the contractor and any additional fees paid by the contractor; including additional DCA fees for items that were left off by the contractor."
- 4.14.3 Delete the following "direct the contractor to secure the service for such special or additional inspections, testing or approvals and the contractor shall give notice as provided for in 4.14.1." and replace with "tell the contractor what needs to be tested or approved and the Owner will hire an independent inspection agency for all special testing to test and/or approve that item."
- 4.14.4 Delete in its entirety

### 4.16 EQUIPMENT – MATERIAL

Add the following paragraphs:

#### 4.16.11 Delivery, Storage & Protection

1. Materials stored on the Site shall be neatly arranged and protected, and shall be stored in an orderly fashion in locations that shall not interfere with the progress of the Work or with the daily functioning of the Institution.

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2. Should it become necessary during the course of the Work to move materials or equipment stored on the Site, the Contractor, at the direction of the Owner, shall move such material or equipment.
  3. Contractor shall furnish to the Owner's Field Representative a copy of each material order, indicating date of order and quantity of material, and shall also notify the Owner's Field Representative when material has been delivered to the site and state the quantities.
  4. Manufacturer's containers shall be delivered with unbroken seals and shall bear proper labels.
  5. Contractor shall coordinate deliveries in order to avoid delay in, or the impeding of the progress of the Work. Deliveries shall be made during regular work hours, unless approved otherwise by the Owner and contractor must be on-site to receive and off load the deliveries.
  6. Stacking - All materials shall be properly stacked in convenient places adjacent to the Work, or in other areas approved by the Owner's Field Representative, and protected as recommended by the respective material manufacturer.
  7. Overloading - If approval is given to store materials in any part of the building area, they shall be so stored as to cause no overloading of the existing structure.
  8. No Interference - If it becomes necessary to remove and restack materials to avoid impeding the progress of any part of the Work or interfering with the work to be done by any other contractor, or interfering with the Universities activities, Contractor shall remove and restack such materials at no additional cost to the Owner.
  9. If a crane is required to off load and hoist equipment, it is the contractors responsibility to hire the crane and riggers with all permits required. If Jersey City Police are required to direct traffic or close streets, this shall be accounted for and paid for by the contractor.
  10. If delivery trucks require no parking on streets and/or street closures, etc. to enter/exit the site the contractor shall coordinate this in advance with JCPD and pay all required fees.
  11. The contractor shall have flag men guiding all vehicular traffic in and out of the campus.
- 4.16.12 The University shall not be limited to only standard colors for all materials and equipment. The Contractor shall include all costs in the bid proposal related to premium and/or custom colors for all materials and equipment.

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### 4.17 SUBSTITUTIONS

#### 4.17.3 Delete in its entirety and replace with the following:

This section includes administrative and procedural requirements for handling requests for substitutions.

A. Substitution Request Submittal: The Owner will consider requests for substitution during the bid phase of this project only. When requesting approval for substitution, the Contractor shall follow the following procedures:

1. Submit pdf copies of each request for substitution for consideration. If the Submittal is deemed incomplete by the Architect or the Construction Manager, the Substitution Request will be rejected without any further action by the Architect and the Construction Manager.
2. Identify the product or the fabrications or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.
3. Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
  - a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will be necessary to accommodate the proposed substitution.
  - b. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
  - c. Product data, including drawings and descriptions of products and fabrication and installation procedures.
  - d. Samples, where applicable or requested.
  - e. A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
  - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
  - g. The Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents in every respect and is appropriate indicated.
  - h. The Contractor's waiver of rights to additional payment to time that may subsequently become necessary because of the failure of the substitution to perform adequately.
  - i. The Contractor's certification that the proposed substitution will have an equal or better Warranty, Guarantee, and Service Agreement as specified.

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- j. The Contractor's certification that the proposed substitution has received all the necessary approvals from authorities having jurisdiction
4. Architect's Action: If necessary, the Architect will request additional information or documentation for revaluation within two (2) weeks of receipt of a request for substitution. The A/E will notify the Contractor of acceptance or rejection of the substitution within two (2) weeks of receipt of the request, or two (2) weeks of receipt of additional information or documentation, whichever is later. Acceptance will be in the form of a credit change order.
5. Use the product specified if the Architect cannot make a decision on the use of proposed substitute within the time allocated.
6. Should a Substitution Request be approved by the Architect and Construction Manager, the Contractor shall be solely responsible for any revisions required to redesign or reengineer any adjacent or related Work that is affected by the Substitution. Responsibility shall include, but not be limited to: the time and materials required by the Architect, the Construction Manager, the Owner, and their agents; any and all resubmissions to the Authorities having Jurisdiction needed to update all permits; coordination with the Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work, cost for additional items discovered that are required that would not have been required by the basic of design item.

### 4.21 RIGHT TO AUDIT

Delete 4.21 in its entirety and replace with the following:

- 4.21.1 The University reserves the right to audit the records of the Contractor in connection with all matters related to this contract. The Contractor agrees to maintain its records in accordance with generally accepted accounting principles, for a period of not less than five (5) years after receipt of final payment. "Generally Accepted Accounting Principles" is defined as follows: Accounting records must identify all labor and material, costs and expenses, whether they be direct or indirect. The identity must include at least the project number for direct expenses and/or account number for indirect expenses. All charges must be supported by appropriate documentation, including, but not limited to cancelled checks. Such records shall be made available to the New Jersey Office of the State Comptroller upon request.
- 4.21.2 The Contractor shall develop, maintain and make available to the Contracting Officer on request such schedule of quantities and costs, progress schedules, daily construction reports, payrolls, reports, estimates, change orders, preconstruction and progress photos and videos, all original estimates, takeoffs, and other bidding documents, all Subcontractors and Supplier Contracts and changes, all records showing all costs and liabilities incurred or to be incurred in connection with the project including all Subcontractor and Supplier costs, all payment records and all records showing all costs incurred in labor and personnel of any kind, records and other data as the University may request concerning work performed or to be performed under this Contract.
- 4.21.3 The Contractor acknowledges and agrees that no claim for payment which is premised to any degree upon actual costs of the contractor shall be recognized by the University except and to the extent that such actual costs are substantiated by records required to be maintained under these provisions.



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4.21.4 The Contractor acknowledges and agrees that the Contractor's obligation to establish, maintain and make available records and the University's right to audit as delineated herein, shall extend to actual costs incurred by subcontractors in performing work required under the contract or any supplemental agreement thereto. The contractor shall require in all subcontracts that the Subcontractor establish, maintain and make available to the University all records as defined and delineated herein relating to all work performed under the subcontractors including work performed by a Sub-Subcontractor.

### ARTICLE 5 SPECIAL RESPONSIBILITIES

5.1.1 Add the following:

The lump sum contractor shall have a full time, English speaking, on-site super(s) at all times and all sub-contractor shall have full-time foremen as required. They all shall have working, activated, cell phones so they can be contacted during and after working hours if required.

5.1.3 Delete in its entirety, and replace with the following:

"No contractor signs/advertising shall be posted. The only signage required are way finding signs, emergency/safety signs, and any state mandated signage as required."

5.3 PHOTOGRAPHS

Delete section in its entirety, see Division 1 Section 01 32 33

5.5 SITE SECURITY

5.5.1 Delete the following:

"The project site shall be fenced as specified below (6.9) and the contractor shall control access when gates are unlocked or open."

Add the following:

5.7 MISCELLANEOUS ITEMS

1. Contractor shall provide a detailed list of all equipment supplied that is over \$1,000. These items shall include the following information: Name of equipment, tag #, material cost, location installed, date installed, date purchased, serial numbers, and life expectancy.
2. The contractor is to submit invoices for all the smart start incentives that NJCU is going to apply for. These are but not limited to: all lighting, all motors (equipment with motors), all VFD's, etc..
3. The CCTV must remain operational at all times. When the ceiling is demoed the cameras must be temporarily secured back in place and coordinated with Public Safety to make sure they are clear and functional.
4. The lighting in the occupied areas must remain operational at all times including common areas where construction is taking place. Temporary lighting must also be maintained in unoccupied areas as access may be required by occupants, public safety, CM, A/E, DCA, etc during all hours.
5. The tele/data equipment in mechanical rooms must be protected at all times from damage and dust.

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6. The elevator lobbies, stairs, corridors, bathrooms and MEP rooms must be free of debris at all times. These areas must also be swept, vacuumed and/or moped at the end of each shift. Any panels and/or equipment that gets dusty/dirty must be cleaned out, if it needs a shut down this must be done on off hours at the contractor's expense.
7. If the elevator is being used the walls and floor shall be protected. The floors and walls shall be swept and moped down at the end of each shift and more if deemed necessary. If it stops working when using it, it will be the GC's responsibility to call the Owner's service company for service prior immediately and shall be responsible for the repair cost. The occupants of the building shall have 1<sup>st</sup> priority to use the elevators when the building is open and contractors shall not interrupt the building functions.
8. The contractor is responsible to protect all furnishing and equipment remaining in the construction areas including the blinds/drapes.

### ARTICLE 6 TEMPORARY FACILITIES, UTILITIES AND SERVICES

- 6.1.1 Delete the following: "The field office may be removed upon enclosure of a Building at which time if directed by the A/E contents and operations will be transferred to the Interior of the Building". Add the following: "The contractor cannot have an on-site office trailer for this project. They must use the areas of construction for their office to house all required staff and documents."
- 6.1.2 Delete in its entirety and replace with the following: "The contractor provide janitorial service weekly for the CM's office space during normal working hours and provide the following items:"
  1. Hot and cold water machine with service contract to supply water and cups as needed
  2. Keurig coffee machine with service contract to supply coffee, filters, hot and cold cups/lids, stirs, hot chocolate, iced and hot teas, creamers, etc
  3. Dell UltraSharp 34 Curved Ultrawide Monitor: U3415W (2)
  4. Cases of 8 ½" x 11" copy paper (3)
  5. Cases of 8 ½" x 14" copy paper (1)
  6. Cases of 11" x 17" copy paper (3)
  7. LED Flashlights (2)
  8. 20', 25', and digital Tape measures
  9. (4) rolls of painters tape (1", 1-1/2", 2")

Add the following:

6.7.10 This contractor shall pay for all temporary heat usage regardless of source (gas, electric, propane, etc.). If the building gas, electrical, etc systems are used this shall be metered separately and shall be the responsibility of the contractor to pay and coordinate.

### ARTICLE 8 RELATIONSHIP BETWEEN OWNER AND CONTRACTOR

#### 8.3 CONTRACTOR'S CLAIM FOR DAMAGES

Delete 8.3 in its entirety and replace with the following:

8.3.1 Any claims made by a Contractor against the University for damages or extra costs are governed by and subject to the New Jersey Contractual Liability Act, N.J.S.A. 59:13-1 et seq. as well as all the provisions in this contract.

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8.3.2 Should any contractor or Architect/Engineer having, or who shall hereafter have, a contract with the University, by its own acts, errors or omissions, damage or unnecessarily delay the Work of the University, Architect/Engineer, or other contractors by not properly cooperating with them, or by not affording them reasonably sufficient opportunity or facility to perform Work as may be specified, by reason of which act, error or omission of the said contractor, the Architect/Engineer or any other contractor shall sustain damages, including delay damages, during the progress of the Work hereunder, then the injured contractor or Architect/Engineer shall have a right of action in court to recover such damages directly from the culpable party. The University shall not be liable to any contractor for any damages or extra costs caused by any acts or omissions as specified in this paragraph and the contractor's exclusive remedy shall be against the culpable party. Nothing contained in this Paragraph shall be construed to relieve the culpable contractor or Architect/Engineer from any liability or damage sustained on account of such acts, errors or omissions.

8.3.3 Should the Contractor sustain any damage through any act or omission of any other contractor having a contract with the University, or through any act or omission of a subcontractor of any such contractor, or through any act or omission of the Architect/Engineer, the Contractor shall have no claims against the University for such damage, but shall have a right of action to recover such damages from the causing party or parties.

### 8.4 TIME OF COMPLETION – DELAY – LIQUIDATED DAMAGES

8.4.6 Change the amount from “\$100.00 for each occurrence” to “\$500.00 for each occurrence”.

### 8.5 NO DAMAGES FOR DELAY

Delete 8.5 in its entirety and replace with the following:

8.5.1 The University shall have the right to defer the beginning or to suspend the whole or any part of the Work herein contracted to be done whenever, in the opinion of the Contracting Officer, it may be necessary or expedient for the University to do so. And if the Contractor be delayed in the completion of the Work by act, neglect or default of the University, or the Architect/Engineer, or of any other Contractor employed by the University upon the work, or by change orders in the work, or by strikes, lockouts, fire, unusual delay by common carriers, unavoidable casualties, or any case beyond the Contractor's control, or by any cause which the Contracting Officer shall decide to justify the delay, then for all such delays and suspensions the Contractor shall be allowed one day addition to the time herein stated for each and every day of such delay so caused in the completion of the work, the same to be determined by the Contracting Officer, and a similar allowance of extra time will be made for such other delays as the Contracting Officer may find to have been caused by the University. No such extension shall be made for any one or more of such delays unless within three (3) working days after the beginning of such delay a written request for additional time shall be filed with the Contracting Officer.

8.5.2 The Contractor may not assert claims against the University for extra compensation by reason of any delays in its work resulting from acts or omissions of any third parties irrespective of extensions granted under the contract, including but not limited to delays caused by third parties such as the project architect, other contractors, utilities and governmental authorities.

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- 8.5.3 The University shall only be required to pay additional compensation for delays caused by the University itself, and only to the extent required by N.J.S.A. 2A:58B-3 (delayed performance caused by the University's own negligence, bad faith, active interference or other tortious conduct, but not for reasons contemplated by the parties and not for the negligence of others including others under contract with the University on the theory that such negligence should be imputed to the University). The University shall not be liable for any period of delay when there is a concurrent delay for which it is not responsible.
- 8.5.4 When the Contractor is entitled to extra compensation for delay under the contract and general conditions, it can only assert claims for extra costs at the job site, and may not assert claims for extra costs for home office expenses, home office overhead, lost profit or consequential losses. Any additional compensation under this paragraph shall also be subject to the provisions in the contract and general conditions regarding claims, and the provisions in the contract and general conditions regarding the maintenance and availability of cost records.

Add the following Article:

### **8.8 OWNER'S RIGHT TO ACCELERATE**

- 8.8.1 If, based on his observation, or a written report by the CM or Architect regarding a Contractor or a written report of a Contractor regarding another Contractor, the CM is of the opinion that a Contractor on this project is failing to coordinate his work with the work of others or is delaying the project, he may issue a directive to the delinquent Contractor(s) as the situation may require including an order to accelerate as provided in paragraph 8.8.2 herein. The Owner, however, shall not be liable for any damages suffered by any Contractor by reason of another Contractor's default, delinquency, or timing of performance; it being understood that the Owner does not assume responsibility for the acts or omission of any Contractors.
- 8.8.2 The Owner through the CM may order and direct the Contractor responsible for delay as described in 8.8.1 or as may be apparent as a result of his observation of the Work, to accelerate that Contractor's Work at any particular place or places by increasing his forces, working overtime and/or on Saturdays, Sundays and holidays as may be required to enable others to carry on with their Work in accordance with the Project Progress Schedule. The cost of such acceleration efforts shall be borne entirely by the responsible Contractor.
- 8.8.3 Should the delaying Contractor not advance the project consistent with the directives or acceleration notices issued, the Owner may contract portions of the work with another Contractor and back charge the delaying Contractor.

## **ARTICLE 9 CONSTRUCTION PROGRESS**

### **9.1 PROGRESS MEETINGS**

- 9.1.1 Delete in its entirety, see Division 1 Section 01 31 00.

### **9.2 GENERAL SCHEDULE REQUIREMENTS**

- 9.2 Delete in its entirety, see Division 1 Section 01 32 00

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### 9.3 EXTENSIONS, COMPENSTATION FOR CERTAIN EXTENSIONS

9.3 Delete in its entirety and replace with the following:

9.3.1 The Contract completion time or times will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract Completion Date, the Contractor shall furnish such justification and supporting evidence that the University or the Construction Manager requires to evaluate the Contractor's request. The Contracting Officer shall then make its finding of fact and advise the Contractor in writing thereof. If the Contracting Officer finds that the Contractor is entitled to any extension of any Contract Completion Date under the provisions of this Contract, the determination as to the total number of days extension shall be based upon the currently approved computer-produced calendar-dated schedule and on all data relevant to the extension. Such data will be included in the next updating of the schedule.

9.3.2 Two (2) types of time extensions may be issued for this project as follows:

- (1) A total project time extension may be issued if delays which are determined to be beyond the control of the Contractor affect the main project critical path shown on the CPM Schedule thereby directly extending the final project completion date.
- (2) A concurrent project time extension may be issued in those instances where it is found that specific delays beyond the control of the Contractor would have affected the final project completion date were it not for overriding delays due to other causes. If a concurrent project time extension is issued, it will over that time which, according to the CPM Consultant's analysis, would have been lost due to the specific issues cited, if no other delays had occurred. A concurrent project time extension will also excuse the Contractor from responsibility for liquidated damages for the period of time extension.

9.3.3 The Contractor acknowledges and agrees that the evaluation of project delays and determinations regarding project time extension will be based upon the project CPM schedule and the following criteria:

- (1) Float time shown on the CPM schedule is not for the exclusive use of either the Contractor or the University. It is agreed that float time is available for use by all parties to facilitate the effective use of available resources and to minimize the impact of problems or Change Orders which may arise during construction. The Contractor specifically agrees that float time may be used by the University or its Representatives or Consultants in conjunction with their review activities or to resolve project problems. The Contractor agrees that there will be no basis for a project time extension as a result of any project problem, Change Order or delay which only results in the loss of available positive float on the project CPM schedule. The Contractor further agrees that there will be no basis for a claim for cost escalation for any activity which is completed on or before its initially required late end date as shown on the initial approved CPM schedule, regardless of the justifiability or any delaying factors which might have resulted in elimination of float which was originally available for the activity. If the Contractor refuses to perform work which is available to them, the Contracting Officer may, regardless of the float shown to be available for the work, consider the Contractor to be in violation of the Contract Documents. In such instances, the Contracting Officer may, without prejudice to any right or remedy, and after giving the Contractor and its Surety three (3) working days written notice to forthwith commence and continue with the work with diligence and promptness, terminate the employment of the Contractor by the issuance of a written notice to that effect to the Contractor and its Surety at any time subsequent to three (3) working days

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thereafter, should they, or either of them, fail to comply with the directive of the original three (3) day notice mentioned above.

- (2) The Contractor agrees that no time extension will be granted for time lost due to normal seasonal weather conditions. In order to qualify for consideration for a time extension due to adverse weather conditions, it must be shown that the weather conditions during a given quarterly period (summer, fall, winter, spring) were more severe than the previous five year average for the project geographical area and, in addition, that these weather conditions critically impacted the final project completion date by delaying the performance of work on the main project critical path. If abnormal weather losses can be shown to have affected the project critical path, a non time extension will be considered for that portion of the proven weather-related delays which exceeded the normal weather losses which should have been anticipated for the quarterly period in question.

No time extensions will be considered for any weather impacts which do not affect work on the main project critical path.

- (3) In order for a given issue (i.e., delay, Change Order, etc.) to be considered as a basis for a total project time extension, it must meet both of the following criteria:
- (a) It must be totally beyond the control of the Contractor and due to no direct or indirect fault of the Contractor; and
  - (b) It must result in a direct delay to work on the main project critical path.
- (4) The Contractor acknowledges and agrees that actual delays to activities which, according to the computer-produced calendar-dated schedule, do not directly affect the main project critical path do not have any effect on the Contract Completion Date or dates and will not be the basis for a change therein.
- (5) Concurrent delays are defined as two (2) or more delays or areas of work slippage which are totally independent of one another and which, if considered individually, would each affect the final project completion date according to the CPM schedule.

Where the University determines that concurrent delays exist, the Contractor acknowledges and agrees that the following criteria will be used to evaluate time extension:

- (a) If the current CPM schedule shows two (2) or more concurrent delays, with one (1) analyzed to be the responsibility of the University and the other analyzed to be the responsibility of the Contractor, a time extension will only be considered if the excusable delay affects the main project critical path and if this delay is shown by a greater amount than the other concurrent delays when their impacts are independently considered. In this event, a time extension will only be considered for that portion of time by which the excusable delay exceeds all concurrent non-University caused delays. For example, if an excusable impact delays the project by 100 days and concurrent Contract-caused slippage independently delays the final completion date by 90 days, a time extension will only be considered for a maximum of ten (10) days, provided the excusable delay is on the project critical path.

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- (b) If the CPM Schedule shows concurrent delays with some excusable delays and some the fault of the Contractor, and if the Contractor-caused delays are analyzed to be the main determination impact to the main project critical path, then there will be no basis for a total project time extension regardless of the nature of the concurrent excusable delays. A concurrent time extension, however, may be considered for that portion of the total project slippage which is shown on the CPM schedule to be totally attributable to excusable delays.
- (c) If a time extension request is made for concurrent delays which did not affect the project critical path, this must be clearly stated in the Contractor's time extension request, and all CPM activities which are claimed to have been affected by the cited delay must be specifically identified with all applicable impact dates.

### ARTICLE 10 PAYMENTS

Delete in its entirety and replace with the following:

#### 10.1 Contractor Payments from the University

- 10.1.1 The University will make progress payments monthly as the work proceeds. The University will endeavor to approve payments twenty (20) calendar days after receipt of a fully executed application for payment with all required attachments as required in the Contract Documents, and provide to the Contractor a written statement of the amount withheld and the reason for withholding payment, before the end of the 20-day period. The University shall pay the amount approved and due to the Contractor for each progress payment not more than 30 calendar days after the approval date signed by the University.
- 10.1.2 The Contractor shall furnish schedule of values in accordance with the Contract requirements. The schedule of values, as approved, shall be used as a basis for the Contractor's estimates for progress payments. Approval by the Contracting Officer does not constitute acceptance of the allocability and allowability of costs to a specific element of work. The Contractor is cautioned that no payment requests shall be approved until the schedule of values has been approved in writing, by the Contracting Officer or its authorized representative.
- 10.1.3 In the preparation of applications for payment, the Contracting Officer, at its discretion, may authorize payment for material and equipment stored onsite. Material delivered to the Contractor at locations other than the site shall not be approved for payment even though there is no room on-site to store the material.
- 10.1.4 The University shall not approve advance payments and/or deposits if requested by subcontractors or suppliers. Any advance payments required by subcontractors or suppliers shall be made by the Contractor and not passed onto the University.
- 10.1.5 In making such progress payments for Work, the University will retain 2% of the approved completed and stored to date amount and shall be deposited in an interest bearing account with a bank; and shall be released and paid to the contractor within 45 days of final acceptance of the project by the University as per PL. 2013, c. 147. If the Contractor elects to provide a retainage bond in the amount of 2% of the total contract value, the 2% retainage will not be retained by the University. All material and work covered by progress payments made shall thereupon become the sole property of the University, but this provision shall not be construed as relieving the Contractor from the sole responsibility for the care and protection of all materials and work upon which payments have been made or the restoration of any damaged work, or as waiving the right of the University to require the fulfillment of all of the terms and conditions of the Contract.

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- 10.1.6 If performance and payment bonds are required under this contract, the University shall pay to the Contractor the total premiums paid by the Contractor to obtain the bonds. This payment shall be paid at one time to the Contractor together with the first progress payment otherwise due after the Contractor has (1) furnished the bonds (including coinsurance and reinsurance agreements, when applicable), (2) furnished evidence of full payment to the surety company, and (3) submitted a request for such payment. The payment by the University of the bond premiums to the Contractor shall not be made as increments of the individual progress payments and shall not be in addition to the contract price.
- 10.1.7 Upon substantial completion and acceptance of all work, the amount due the Contractor under this contract, including retainage, shall be paid upon satisfactory completion, by the Contractor, of all contract close-out requirements, completion of a University audit on all contract values and payments, and after the Contractor shall have furnished the University with a release of claims against the University, arising by virtue of this contract, other than claims in stated amounts as may be specifically excepted by the Contractor from the release.
- 10.1.8 If, for any reason, the Contractor refuses final payment, the project shall be closed out by the University unilaterally processing a Final Acceptance Certificate. All residual funds will be held in escrow by the University until all claims of the University and all Contractors are satisfied.
- 10.1.9 In addition to other warranties required by provisions of the Contract and Specifications, the Contractor warrants that title to all Work, materials and equipment covered by an Application for Payment will pass to the University, either upon incorporation into the construction or upon receipt of payment by the Contractor, whichever occurs first, free and clear of all liens, claims, security interests or encumbrances. This provision shall not be construed as relieving the Contractor from sole responsibility for the care and protection of materials and Work upon which payments have been made, or the restoration of any damaged Work, or as a waiver by the University of its rights to require fulfillment of all terms of the Contract.
- 10.1.10 Approval of the Contractor's application for payment will constitute a representation by the Construction Manager to the Contracting Officer, based on its inspections at the site and data contained in the application for payment, that the Work has progressed to the point indicated; that, to the best of its knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents; and that the Contractor is entitled to payment in the amount certified. By approval of the application for payment, however the Construction Manager shall not thereby be deemed to represent that he has made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, or that he has reviewed the construction means, methods, techniques, sequences or procedures, or that he has made any examination to ascertain how and for what purpose the Contractor has used the monies previously paid on account of the Contract Sum.
- 10.1.11 Pursuant to N.J.S.A. 54:49-19, and notwithstanding any provision of the law to the contrary, whenever any taxpayer, partnership or S corporation under contract to provide goods or services or construction projects to the State of New Jersey or its agencies or instrumentalities, including the legislative and judicial branches of State government, is entitled to payment for those goods or services at the same time a taxpayer, partner or shareholder of that entity is indebted for any State tax, the Director of the Division of Taxation shall seek to setoff that taxpayer's or shareholder's share of the payment due the taxpayer, partnership, or S corporation. The amount set off shall not allow for the deduction of any expenses or other deductions which might be attributable to the taxpayer, partner or shareholder subject to set-off under this act.



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- 10.1.12 The Director of the Division of Taxation shall give notice to the set-off to the taxpayer and provide an opportunity for a hearing within thirty (30) days of such notice under the procedures for protests established under R.S. 54:49-18. No requests for conference, protest, or subsequent appeal to the Tax Court from any protest under this section shall stay the collection of the indebtedness. Interest that may be payable by the State, pursuant to P.L. 1987, c.184 (c.52:32-32 et seq.), to the taxpayer shall be stayed.
- 10.1.13 The Contractor shall pay each Subcontractor, no later than seven calendar days after receipt of payment from the University the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.
- 10.1.14 The Contracting Officer will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the University, Construction Manager and Architect on account of portions of the Work done by such Subcontractor.
- 10.1.15 The Contracting Officer has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the University to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven calendar days, the University shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the University, Construction Manager nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.
- 10.1.16 The Contracting Officer or its authorized representatives may withhold payments in whole or in part, to the extent reasonably necessary to protect the University, if in the Contracting Officer's or its authorized representatives opinion the representations to the University required by the Contract Documents cannot be made. If the Contracting Officer or its authorized representatives are unable to certify payment in the amount of the application for payment, the Construction Manager will notify the Contractor and The University. If the Contractor, Construction Manager and Architect cannot agree on a revised amount, the Contracting Officer or its authorized representatives will promptly issue an application for payment for the amount for which the Contracting Officer or its authorized representatives are able to make such representations to the University. The Contracting Officer or its authorized representatives may also withhold payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole or a part of a payment previously issued, to such extent as may be necessary in the Contractor Officer's or authorized representatives opinion to protect the University from loss for which the Contractor is responsible, including loss resulting from the acts and omissions because of:
- (1) defective Work not remedied;
  - (2) third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the University is provided by the Contractor;
  - (3) failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
  - (4) reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
  - (5) damage to the University or a separate contractor;

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- (6) reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- (7) repeated failure to carry out the Work in accordance with the Contract Documents.

When the above reasons for withholding certification are removed, payments will be made for amounts previously withheld.

10.1.17 The Contracting Officer or its authorized representatives may reduce line items previously approved and paid should it be found that the work represented as complete is rejected or not complete. Held retainage will not serve for these discoveries.

10.1.18 If the Contracting Officer withholds certification for payment under this article, the University may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered.

10.1.19 If closeout requirements are not delivered within the time specified by this contract or are deficient upon delivery, the Contracting Officer, at its discretion, will withhold from each invoice a percentage (in addition to any other retainage required by the Contract) or the contract price in accordance with the table below. The withholding of any sums pursuant to this Article shall not be construed as, or constitute in any manner, a waiver by the University of the Contractor's obligation to furnish the data required under this contract. In the event the Contractor fails to furnish these items, the University shall have those rights and remedies provided by law and pursuant to this contract in addition to, and not in lieu of, the sums withheld in accordance with this Article.

<u>When total contract amount is</u>	<u>Percentage to be withheld is</u>
Less than \$250,000.....	10% of total contract
\$250,000 to \$1,000,000.....	5% of total contract
Over \$1,000,000.....	2% of total contract

10.1.20 When the CM and/or Engineer requires substantiating information to justify payment of a specific line item, the contractor shall submit required data justifying the dollar amounts in question.

10.1.21 For approval of progress payments the CM is to review and confirm the as-built plans are being updated. If they are not, the application for payment shall not be approved.

**10.2 Final Application for Payment**

10.2.1 Upon completion of the Work, the Contractor shall forward to the Contracting Officer a written notice that the Work is ready for final inspection and acceptance and shall also forward to the Contracting Officer a final Contractor's Application for Payment. Upon receipt, the Contracting Officer and its authorized representatives will evaluate the completion of Work of the Contractor and then forward the notice and Application, with recommendations, to the Architect who will promptly make such inspection. When the Architect, finds the Work acceptable under the Contract Documents and the Contract fully performed, the Contracting Officer will promptly issue a final application for payment stating that to the best of their knowledge, information and belief, and on the basis of their on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Application for Payment is due and payable.

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10.2.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Contracting Officer (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the University or the University's property might be responsible or encumbered (less amounts withheld by the University) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the University, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment and (5), if required by the University, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the University. If a Subcontractor refuses to furnish a release or waiver required by the University, the Contractor may furnish a bond satisfactory to the University to indemnify the University against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the University all money that the University may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

### 10.3 Interest

10.3.1 Interest shall be paid on the amount due the Contractor pursuant to a properly executed State invoice if a required payment is not made as provided in Section 10.1.1 above.

10.3.2 Interest on amounts due shall be paid to the Contractor for the period beginning on the day after the required payment date and ending on the date on which the check for payment is drawn. The interest shall be paid at a rate equal to the prime rate plus 1%, pursuant to the New Jersey Prompt Payment Act, N.J.S.A. 2A:30A-2(c).

10.3.3 No interest charge as required by this provision shall become a debt of the State until it exceeds \$5.00.

10.3.4 Interest may be paid by separate payment to the Contractor, but shall be paid within thirty (30) calendar days of payment of the original invoice.

10.3.5 The State Treasurer shall have the right to waive the interest payment for delinquencies due to circumstances beyond the control of the Contracting Officer (or other State or University representatives involved in the processing of contractor invoices) including but not limited to strikes and natural disasters.

10.3.6 Nothing in this provision nor the New Jersey Prompt Payment Act shall be construed as permitting the accrual of prejudgment interest in the case of a disputed contract for which a notice of claim has been filed pursuant to N.J.S.A. 59:13-1 et reg., except as provided in N.J.S.A. 59:13-8.

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### 10.4 Payment Disputes - Claims Against the University

10.4.1 All claims by the Contractor against the University arising under this Contract shall be governed by the N.J. Contractual Liability Act, N.J.S.A. 59:13-1 et seq., including the notice of claims provisions therein (see N.J.S.A. 59:13-5).

10.4.2 Where a timely notice of claim has been submitted to the University by the Contractor pursuant to N.J.S.A. 59:13-5, the University and the Contractor agree to submit the dispute to a mutually agreed upon mediator for mediation as provided by N.J.S.A. 2A:23C-2, with the mediator's fees to be shared equally among the mediation parties. This alternative dispute resolution process is adopted by the University and the Contractor in compliance with the N.J. Prompt Payment Act, N.J.S.A 2A:30A-2(f).

## ARTICLE 14 CHANGES IN THE WORK

### 14.2 CHANGE ORDER PROCEDURE

14.2.1 Delete in its entirety, see Division 1 Section 01 26 00

Delete the following sections in its entirety  
14.2.6, 14.2.7, 14.2.8, 14.2.10, 14.2.11

And replace with the following:

"Requests for time extensions shall also be prepared within seven (7) days. All requests for time extensions shall be accompanied by copies of the current (approved) Project CPM Schedule and copies of the revised (proposed) Project CPM Schedule detailing the incorporation of the changed work and the effect of such incorporation on progress. Failure to provide the schedule data shall be grounds for rejection of the request."

Proposed Change Order shall be submitted for approval by the Construction Manager, architect/engineer and the Owner, and include the following components:

1. All Contractor change order requests shall be submitted on the "General & Sub Contractor(s) Change Order Proposal Forms" provided in section 00 60 03 & 00 60 04 and noted in section 01 26 00. All four (4) pages, for each, are required to be submitted with each change order request and shall include the following:
  - A. Direct Labor – The term direct labor shall include working foremen (nonworking foremen are considered overhead), journeymen, apprentices, equipment operators, and/or laborers directly assigned to the approved change in work by the Contractor. The total hourly rate shall be calculated and include only the following:
    - i. Base hourly rate consistent with the requirements of the New Jersey Prevailing Wage Act law or local union hourly rates if the Contractor is union. If union, the Contractor must provide the local union bi-laws for confirmation of the hourly rate.
    - ii. Labor burden shall only include social security and Medicare taxes, federal unemployment taxes, state unemployment taxes, and workman's compensation.
    - iii. Fringe costs consistent with the requirements of the New Jersey Prevailing Wage Act law or local union. Fringe costs shall only include, if applicable, welfare, pension, annuity, and education/training benefits. Costs such as travel, small tools, vacation, etc. are considered overhead costs. If union, the Contractor must provide the local union bi-laws for confirmation of fringe costs.

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B. Direct Materials – Direct material costs shall consist of the actual cost of materials including applicable taxes and transportation charges. Contractors shall submit a copy of bill of materials that list all materials to be used, quantities, unit prices and extensions without overhead and profit.

C. Direct Equipment – Rental and operating costs for equipment only, either rented or owned, by the Contractor. The equipment shall be listed with quantity of hours and hourly rate. For verification of the rate charged, the Contractor shall furnish a comparable rental rate from a vendor should the equipment be owned by the Contractor. Costs for operation will only be approved for actual operation for the approved change in work regardless on the time the equipment is onsite.

D. Contractor Markup - A markup of 10% shall be applied to the subtotal of items A through C above for self-performed work only. This markup shall cover profit and overhead/general condition costs such as dumpsters, office personnel, field personnel including superintendents, scheduling managers and services, permits, mailing, misc. reproduction, safety, temporary utilities, company vehicles and mileage, etc. Any and all costs not defined in items A through C above are considered overhead. The 10% markup shall apply to deleted work as well.

E. Subcontracted Work – All Subcontractor change order work shall be submitted on the "Subcontractor Change Order Proposal Form" and attached to the "General Contractor Change Order Proposal Form". A markup of 10% by the subcontractor shall be applied to the work self-performed by the Subcontractor. This markup shall cover profit, insurances, bonding, and overhead/general condition costs such as dumpsters, office personnel, field personnel including superintendents, scheduling managers and services, permits, mailing, misc. reproduction, safety, temporary utilities, company vehicles and mileage, etc. Any and all costs not defined in items A through C above are considered overhead. The 10% markup shall apply to deleted work as well. When more than one tier of subcontracts exists, for the purpose of markups, they shall be treated as one subcontract.

F. Contractor Markup on Subcontracted Work – A markup of 5% shall be applied to the subtotal of subcontracted work only. This markup shall cover profit, and overhead/general condition costs related to subcontracted work such as dumpsters, office personnel, field personnel including superintendents, scheduling managers and services, permits, mailing, misc. reproduction, safety, temporary utilities, company vehicles and mileage, etc. The 5% markup shall apply to deleted work as well.

G. Bonds and Insurances – A separate 2% mark-up for Bonds and Insurances will be allowed for the General Contractor only on top of items A through F above. A separate mark-up for Bonds and Insurances will not be allowed for Subcontractors. No additional costs for bonds and insurance will be permitted on change order work.

2. The Contractor must review submitted subcontractor change order proposals prior to submission to the Owner and make any corrections necessary. When the Contractor fails to review change order proposals and submits the proposals to the Owner with obvious accounting errors or if the work is clearly defined in the Contract Documents, the Contractor will be responsible for all costs incurred by the Owner for review time by its professionals. Submission of a change order proposals that contains falsified information, altered documents, or identifies costs in excess of the actual cost shall constitute a breach of this Contract.
3. In the instance of a change resulting in a deduction in the contract amount, the amount shall be based on actual cost of such Work and not the amount represented in the Contractor's schedule of values and shall include the mark-ups.

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

14.2.3 Delete in its entirety and replace with the below:

The Owner has the option of having work performed under Method 1 "Agreed Lump Sum" or Method 2 "Time and Material" basis or Method 3 "Unit Price". The Contractor shall submit "Unit Price" and "Time and Material" labor rate information as per the requirements of the General Conditions.

A. METHOD 1 Agreed Lump Sum Basis

When time and conditions permit, the Owner prefers changes be worked on a lump sum basis. The Contractor shall provide a breakdown of estimated costs for materials, labor, and mark-up sufficiently detailed as per Article 14.2 (listed above) to allow a reasonable check of the validity of the submitted lump sum cost. The Construction Manager may accept, reject or negotiate a lump sum price agreeable to both parties for the change. When such lump sum price is agreed upon, it shall then become the price for the change and will be incorporated into the Contract via Change Order. Reference Article 14.2 (listed above) for allowable mark-up percentages.

B. METHOD 2 Time and Material (Not to Exceed)

If the University and the contractor cannot come to terms on a lump sum cost for the proposed work, the University has the right to direct the contractor to proceed on a "Time and Material" basis not to exceed the contractor's proposed amount. The entire scope of work must be completed in full even if the actual cost exceeds the proposed amount at No additional cost to the University then the originally proposed amount. If time is of the essence then the CM can direct the Contractor to proceed on a Time and Material basis without a lump sum proposal.

The cost of:

- (1) Materials entering permanently into the work.
- (2) Equipment rental cost of construction plant and equipment during the time of use on the work. (Equipment bought specifically for this work and can be reused is to be turned over to the University or retained by the contractor at a discounted cost to the University).
- (3) Labor.
- (4) Mark-up 1 through 3 is 10%
- (5) Subcontractor work
- (6) Mark-up 1 through 5 is 5%
- (7) Bond and Insurance Premiums Max 2%

C. METHOD 3 Unit Price

- a. The Owner may request change orders utilizing the Unit Prices contained in the contractor Proposal Form. Measurements and quantities shall be provided to and verified by the CM prior to acceptance of work. The unit price only, is used to determine the cost of Work and shall not be subject to further Contractor's markup.

**When work is performed under Method 2, the Contractor shall furnish satisfactory bills, payrolls, and vouchers covering all items of cost, and when requested by the Owner, shall give the Owner access to accounts relating thereto. Daily confirmation of time and material is required of the Contractor's Superintendent. Contractor shall notify the Construction Manager each morning of all Time and Material Work scheduled to be performed on that day for verification and shall submit signed detailed time and material tickets each day for the day's work for approval. If tickets are not submitted daily the time and material may not be able to be verified and will affect approval cost.**

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

Payment for Standby Time or Overtime shall include a mark-up of not more than a total of ten percent (10%) of the net labor cost to cover the Contractor's mark-up, plus Bond Premium and this limit shall apply whether or not a Subcontractor is involved. Any and all claims for standby time or overtime will be rejected unless previously authorized in writing and documented time sheets are verified and signed by the University's Contracting Officers. Should the Contracting Officer authorize premium time for Work which would otherwise be performed within the Contractor's Scope of Work and not required as a result of the Contractor's fault, additional payment will be made only for the premium portion of the labor cost, plus a total of ten percent (10%) mark-up, plus cost of bond premium, not to exceed two percent (2%).

14.2.13 Upon the approval of the Owner, Construction Manager, and Architect, the Construction Manager will prepare and issue a formal Change Order for execution by all parties.

Add the following Article:

### **14.3 Change Directives**

14.3.1 The Owner, in order to avoid delays in the progress of work, will issue a directive to the Contractor to proceed with the Work when the Owner and the Contractor are unable to reach an agreement on the cost of a change, or when the Construction Manager and the Contractor disagree whether to the work is included in the Contract or not, or if there is not enough time permitted to prepare a change order proposal. Such direction shall be in the form of a letter of direction. See 14.2.3 above for additional details.

14.3.2 Should the Contractor fail to immediately comply with a written letter of direction from the Construction Manager, the Contractor will be held responsible for any lost time or additional expenses resulting from the Contractor's failure to comply.

14.3.3 Where the cost of property made obsolete or excess as a result of a change is included in the Contractor's Request for Change Order, the Owner shall have the right to prescribe the manner of disposition of such property.

14.3.4 Failure to agree to any adjustment shall be a dispute concerning a question of fact within the meaning of the Article 2.6 "Review of Contractor Claims and Disputes". However, nothing in this Article shall excuse the Contractor from proceeding with the Contract as changed.

## **ARTICLE 16 AFFIRMATIVE ACTION REQUIREMENTS**

Delete in its entirety and replace with the following:

### **16.1 Policy Statement**

16.1.1 It has long been the policy of the University to promote equal employment opportunity by prohibiting discrimination in employment and requiring affirmative action in performance of contracts funded by the University. This policy has been reinforced and expended by an act of the Legislature. The new statute, New Jersey Public Law 1975, Chapter 172, provides that no public works contractor can be awarded, nor any monies paid, until the prospective contractor has agreed to contract performance which complies with the approved Affirmative Action Plan. The law applies to each political subdivision and agency of the State and includes procurement and service contracts as well as construction contracts. This section was prepared to explain the affirmative action requirements and procedures for public agencies awarding contracts and for contractors bidding on contracts. To assure effective implementation of the affirmative action law

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

while allowing the business operations of a government to proceed efficiently, these regulations are designed to minimize administrative paperwork, and delays.

### 16.2 Mandatory Affirmative Action Requirements

16.2.1 N.J.S.A. 10:5-33 and N.J.A.C. 17:27-3.5 require that during the performance of this contract, the contractor must agree as follows:

a) The contractor or subcontractor, where applicable, will not discriminate against any employee or applicant for employment because of age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Except with respect to affectional or sexual orientation and gender identity or expression, the contractor will take affirmative action to ensure that such applicants are recruited and employed, and that employees are treated during employment, without regard to their age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause;

b) The contractor or subcontractor, where applicable will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality or sex;

c) The contractor or subcontractor where applicable, will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the agency contracting officer, advising the labor union or workers' representative of the contractor's commitments under this act and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

16.2.2 N.J.A.C. 17:27-3.8 requires all contractors and subcontractors, if any, to further agree as follows;

1) When hiring or scheduling workers in each construction trade, the contractor or subcontractor agrees to make good faith efforts to employ minority and women workers in each construction trade consistent with the targeted employment goal prescribed by N.J.A.C. 17:27-7.2; provided, however, that the Division may, in its discretion, exempt a contractor or subcontractor from compliance with the good faith procedures prescribed by (a)1i and 2 below, as long as the Division is satisfied that the contractor or subcontractor is employing workers provided by a union which provides evidence, in accordance with standards prescribed by the Division that its percentage of active "card carrying" members who are minority and women workers is equal to or greater than the targeted employment goal established in accordance with N.J.A.C. 17:27-7.2. The contractor or subcontractor agrees that a good faith effort shall include compliance with the following procedures:

i. If the contractor or subcontractor has a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor shall, within



## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

three business days of the contract award, seek assurances from the union that it will cooperate with the contractor or subcontractor as it fulfills its affirmative action obligations under this contract and in accordance with the rules promulgated by the Treasurer, pursuant to *N.J.S.A. 10:5-31 et seq.*, as supplemented and amended from time to time. If the contractor or subcontractor is unable to obtain said assurances from the construction trade union at least five business days prior to the commencement of construction work, the contractor or subcontractor agrees to afford equal employment opportunities to minority and women workers directly, consistent with the this chapter. If the contractor's or subcontractor's prior experience with a construction trade union, regardless of whether the union has provided said assurances, indicates a significant possibility that the trade union will not refer sufficient minority and women workers consistent with affording equal employment opportunities as specified in this chapter, the contractor or subcontractor agrees to be prepared to provide such opportunities to minority and women workers directly, consistent with this chapter, by complying with the procedures prescribed under (a)2 below; and the contractor or subcontractor further agrees to take said action immediately if it determines that the union is not referring minority and women workers consistent with the equal employment opportunity goals set forth in this chapter.

2) If good faith efforts to meet targeted employment goals have not or cannot be met for each construction trade by adhering to the procedures of (a)1 above, or if the contractor does not have a referral agreement or arrangement with a union for a construction trade, the contractor or subcontractor agrees to take the following actions:

- i. To notify the public agency compliance officer, the Division, and minority and women referral organizations listed by the Division pursuant to *N.J.A.C. 17:27-5.3*, of its workforce needs, and request referral of minority and women workers;
- ii. To notify any minority and women workers who have been listed with it as awaiting available vacancies;
- iii. Prior to commencement of work, to request that the local construction trade union refer minority and women workers to fill job openings, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade;
- iv. To leave standing requests for additional referral of minority and women workers with the local construction trade union, provided the contractor or subcontractor has a referral agreement or arrangement with a union for the construction trade, the State training and employment service and other approved referral sources in the area;
- v. If it is necessary to lay off any of the workers in a given trade on the construction site, layoffs shall be conducted in compliance with the equal employment opportunity and non-discrimination standards set forth in this chapter, as well as with applicable Federal and State court decisions;
- vi. To adhere to the following procedure when minority and women workers apply or are referred to the contractor or subcontractor:

(1) The contractor or subcontractor shall interview the referred minority or women worker.

(2) If said individuals have never previously received any document or certification signifying a level of qualification lower than that required in order to perform the work of the construction trade, the contractor or subcontractor shall in good faith determine the qualifications of such individuals. The contractor or subcontractor shall hire or schedule those individuals who satisfy appropriate qualification standards in conformity with the equal employment opportunity and non-discrimination principles set forth in this chapter. However, a contractor or subcontractor shall determine that the individual at least possesses the requisite skills, and experience as recognized by a union, apprentice program or a referral agency, provided the referral agency is acceptable to the Division. If necessary, the contractor or subcontractor shall consider the recruitment and hiring or scheduling of minority and women workers who qualify as trainees pursuant to

## SECTION 00 70 10 - SUPPLEMENTAL GENERAL CONDITIONS

these rules. All of these requirements, however, are limited by the provisions of (a)3 below.

(3) The name of any interested woman or minority individual shall be maintained on a waiting list, and shall be considered for employment as described in (a)2vi(2) above, whenever vacancies occur. At the request of the Division, the contractor or subcontractor shall provide evidence of its good faith efforts to employ women and minorities from the list to fill vacancies.

(4) If, for any reason, a contractor or subcontractor determines that a minority individual or a woman is not qualified or if the individual qualifies as an advanced trainee or apprentice, the contractor or subcontractor shall inform the individual in writing of the reasons for the determination, maintain a copy of the determination in its files, and send a copy to the public agency compliance officer and to the Division.

vii. To keep a complete and accurate record of all requests made for the referral of workers in any trade covered by the contract, on forms made available by the Division and submitted promptly to the Division upon request.

3) The contractor or subcontractor agrees that nothing contained in (a)2 above shall preclude the contractor or subcontractor from complying with the union hiring hall or apprenticeship policies in any applicable collective bargaining agreement or union hiring hall arrangement, and, where required by custom or agreement, it shall send journeymen and trainees to the union for referral, or to the apprenticeship program for admission, pursuant to such agreement or arrangement. However, where the practices of a union or apprenticeship program will result in the exclusion of minorities and women or the failure to refer minorities and women consistent with the county employment goal, the contractor or subcontractor shall consider for employment persons referred pursuant to (a)2 above without regard to such agreement or arrangement; provided further, however, that the contractor or subcontractor shall not be required to employ women and minority advanced trainees and trainees in numbers which result in the employment of advanced trainees and trainees as a percentage of the total workforce for the construction trade, which percentage significantly exceeds the apprentice to journey workers ratio specified in the applicable collective bargaining agreement, or in the absence of a collective bargaining agreement, exceeds the ratio established by practice in the area for said construction trade. Also, the contractor or subcontractor agrees that, in implementing the procedures of (a)2 above, it shall, where applicable, employ minority and women workers residing within the geographical jurisdiction of the union.

4) After notification of award, but prior to signing a construction contract, the contractor shall submit to the public agency compliance officer and the Division an initial project workforce report (Form AA201) electronically provided to the public agency by the Division, through its website, for distribution to and completion by the contractor, in accordance with N.J.A.C. 17:27-7. The contractor also agrees to submit a copy of the Monthly Project Workforce Report once a month thereafter for the duration of this contract to the Division and to the public agency compliance officer. The contractor agrees to cooperate with the public agency in the payment of budgeted funds, as is necessary, for on-the-job and/or off-the-job programs for outreach and training of minorities and women.

16.2.3 The contractor or subcontractor, where applicable, agrees to comply with any regulations promulgated by the State Treasurer pursuant to N.J.S.A. 10:5-33, as amended and supplemented from time to time.

### End of Supplemental General Conditions

## **READY FOR CLOSEOUT**

Contractor shall submit a copy of this document with the completed punchlist, signed and sealed by the Contractor's authorized representative and Notarized, to the Construction Manager and Architect indicating that the Work has been completed as required in accordance with the Contract Documents and after which the Contractor shall notify the Construction Manager and Architect when re-inspection is requested.

The undersigned certifies that all items of work noted herein and all other required scope of Work have been completed in accordance with Contract Documents and is further certifying that the project is ready for final inspection by the Architect and Construction Manager. The undersigned acknowledges providing all required close-out documents, including, but not limited to, all affidavits, warranties and a release of liens, to the Architect and Construction Manager.

Items not completed shall be summarized by the Contractor in letter form and attached herewith.

The undersigned hereby certifies that he/she shall pay the Owner for any and all expenses incurred by the Architect or Construction Manager due to the Contractor's misrepresentation of completion of punch list items.

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Authorized Representative of the Contractor (Print/Type)

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Title

---

Signature

Date

THE CONTRACTOR SHALL SEAL THIS PUNCHLIST AS NOTED BELOW:

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Contractor's Corporate Seal

---

Notary Seal

Prepared by: \_\_\_\_\_

Date: \_\_\_\_\_



2039 Kennedy Boulevard  
Jersey City, New Jersey  
07305-1597  
(201) 200-3159

# **DIVISION 1**

**NEW JERSEY CITY UNIVERSITY  
2039 KENNEDY BOULEVARD  
JERSEY CITY, NEW JERSEY 07305-1597**

## **NURSING EDUCATION CENTER**

**PROJECT No. 4131  
BID No. 17-024**

### **General Requirements**

**December 4, 2017**

## **SECTION 01 11 00 – SUMMARY OF WORK**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section specifies the summary of work for the project including, but not necessarily limited to:
  - 1. Project Description
  - 2. Owner Occupancy
  - 3. Items Not In Contract
  - 4. Knowledge of the Contract Requirements
  - 5. Contract Documents Information
  - 6. Construction Phasing Requirements

#### **1.2 PROJECT DESCRIPTION**

- A. The Project consists of, but is not limited to, interior renovation of the existing fourth, fifth, and sixth floors of Rossey Hall. The project will result in state-of-the-art simulation labs with control rooms; low fidelity bed labs; brief/ debrief rooms; student project areas for formal and informal collaboration; a home care simulation lab; a mock quarantine/ clean room; general classrooms equipped with smart technology; computer labs/testing labs with state of the art technology; as well as office space and support spaces for faculty and staff of the nursing department.
- B. The extent of the contract work is indicated in the Contract Documents.
- C. The scope of the work shall not be limited to what is specifically called out on the drawings or specifications, but shall include any and all demolition, temporary work, and new work as well as any cutting and patching as required to accomplish the intended construction.

#### **1.3 OWNER OCCUPANCY**

- A. During the project the Owner will be occupying the ground through fifth floors of the building.
- B. The Owner will be occupying the 4<sup>th</sup> and 5<sup>th</sup> floor office areas that are not being directly impacted by the construction along with the hatched areas on A-101 and A-102.

## SECTION 01 11 00 – SUMMARY OF WORK

### 1.4 ITEMS NOT IN CONTRACT

- A. Items designated NIC (Not in Contract) will be completed by others. Such items of work include:
  - 1. Loose furniture which consists of the following: office furniture (desks, chairs, file cabinets, bookcases, and wall mounted storage), conference room (table and chairs), brief/ debrief rooms (table and chairs), classroom furniture (moveable tables and chairs only), and collaboration space furniture (chairs, tables, and sofas).
  - 2. Designated lab equipment. Although such lab equipment will be furnished by others, the Contractor is required under this contract to connect all pieces of equipment to installed utilities as required. LAERDAL EQUIPMENT AND EXISTING ITEMS TO BE REUSED.
- B. Items that are not listed above and are not clearly identified as “NIC” throughout the Contract Documents are to be furnished and installed under this Contract by the Contractor.

### 1.5 KNOWLEDGE OF CONTRACT REQUIREMENTS

- A. The Contractor and Subcontractor's shall consult in detail all Contract Documents, provide all labor, materials, equipment and services necessary to furnish, install and complete the work in strict conformance with all provisions thereof.
- B. The Contractor will be held to have examined the site of the Work prior to submitting his proposal and informed himself, his Subcontractors, Sub-Subcontractors and material men of all existing conditions affecting the execution of the work.
- C. The Contractor is responsible to examine the Contract Documents as they may affect subdivisions of the work and inform himself, his Subcontractors, Sub-Subcontractors and material men of all conditions thereof affecting the execution of the work.
- D. The Scope of Work for the Contract is not necessarily limited to the description of each section of the Specifications and the illustrations shown on the Drawings. Include all items not expressly indicated in the Contract Documents, or as might be found necessary as a result of field conditions, in order to complete the work as it is intended, without any gaps between the various subdivisions of work of the Contractor and his Subcontractors.
- E. The Contractor will be held to be thoroughly familiar with all conditions affecting labor for the project including, but not limited to, Unions, incentive pay, procurement, living and commuting conditions and to have informed his Subcontractors and Sub-Subcontractors thereof. It is the Contractors responsibility to resolve any labor issues without any additional cost to the Owner.

## SECTION 01 11 00 – SUMMARY OF WORK

### 1.6 CONTRACT DOCUMENTS INFORMATION

- A. The Contract Documents are prepared in accordance with available information as to existing conditions and locations. If, during construction, conditions are revealed at variance with the Contract Documents, notify the Construction Manager and Architect immediately so that supplementary instructions may be issued.
- B. The Specifications determine the kinds and methods of installation of the various materials, the Drawings establish the quantities, dimensions and details of materials, the schedules on the Drawings give the location, type and extent of the materials.
- C. Should the Drawings, Specifications or schedules disagree in themselves or with either or both of the others, the better quality or greater quantity of work or materials shall be performed and provided at no additional cost to the owner, unless otherwise directed in writing by the Construction Manager.
- D. Should an item of work appear in the Specifications and not on the Drawings, or vice versa, all related work items associated with this scope is to be included in the contract at no additional cost to the Owner unless specifically omitted in writing during the bid process.
- E. Dimensions given on the Drawings govern scale measurements and large scale drawings govern small scale drawings, except as to anything omitted unless such omission is expressly noted on the larger scale drawings.
- F. The techniques or methods of specifying to record requirements varies throughout text, and may include "prescriptive", "open generic/descriptive", "compliance with standards", "performance", "proprietary", or a combination of these. The method used for specifying one unit of work has no bearing on requirements for another unit of work.
- G. Whenever a material, article or piece of equipment is referred to in the singular number in the Contract Documents, it shall be the same as referring to it in the plural. As many such materials, articles or pieces of equipment shall be provided as are required to complete the work.
- H. Work included in small details not usually shown or specified, but necessary for the proper installation and operation of the work, shall be provided at no additional cost to the Owner.

### 1.7 CONSTRUCTION PHASING REQUIREMENTS

- A. The construction phasing requirements are per floor, the Contractor is responsible to become familiar with all existing systems and conditions and determine all phasing requirements prior to any work commencing in Rossey Hall. If there is any conflict with the phasing as outlined in the Contract Documents, the Contractor must notify the Architect and Construction Manager immediately for resolution. Should any work be performed prior to the Contractor becoming completely knowledgeable with existing systems and distribution which results in additional work not defined in the Contract Documents, the Contractor will not be entitled to additional compensation or time for the work performed in error.

## SECTION 01 11 00 – SUMMARY OF WORK

B. The Project will consist of the following:

1. Phase 1 – Partial renovation of the existing fifth floor. Work within this phase shall consist of the following but not limited to:
  - a. Temporary work to keep the existing building systems in operation.
  - b. Temporary walls, signage, and barricades required by the authority having jurisdiction and/or the Owner for safety and/or to separate the construction areas from the occupants. This may need to be relocated several times.
  - c. Environmental abatement of areas being renovated in this phase
  - d. Complete fitout for the fifth floor
2. Phase 2 – Partial renovation of the existing fourth floor. Work within this phase shall consist of the following but not limited to:
  - a. Temporary work to keep the existing building systems in operation.
  - b. Temporary walls, signage, and barricades required by the authority having jurisdiction and/or the Owner for safety and/or to separate the construction areas from the occupants. This may need to be relocated several times.
  - c. Environmental abatement of areas being renovated in this phase
  - d. Complete fitout for the fourth floor
3. Phase 3 – Renovation of the sixth floor. Work within this phase shall consist of the following but not limited to:
  - a. Temporary work to keep the existing building systems in operation.
  - b. Temporary walls, signage, and barricades required by the authority having jurisdiction and/or the Owner for safety and/or to separate the construction areas from the occupants. This may need to be relocated several times.
  - c. Environmental abatement of areas being renovated in this phase
  - d. Complete fitout for the sixth floor

C. These special requirements and constraints shall be understood and included in the Contractor's bid proposal in Phase I of the project:

1. Contractor shall install and maintain temporary partitions as needed to keep construction and occupied areas separated. These partitions are to be removed at the completion of Phase I.
2. All demolition and environmental abatement to be completed from 10:00 PM through 6:30 AM.
3. All remaining items including but not limited to loose furniture shall be removed and discarded by this Contractor.
4. All work to be done in the corridors are to be completed from 10:00 PM through 6:30 AM.
5. All work on this floor to be done from 10:00 PM through 6:30 AM.
6. Any work required to be done above the 4<sup>th</sup> floor ceilings or any of the occupied areas shall be completed from 10:00 PM through 6:30 AM with prior notifications and approvals.



## SECTION 01 11 00 – SUMMARY OF WORK

7. Contractor to keep all utilities operational servicing all the occupied floors throughout Phase I. Contractor is required to install and relocate temporary utilities as required between 10:00 PM and 6:30 AM.
  8. Contractor is to provide temporary utility connections as needed until permanent connections can be made if it impacts the occupied areas.
  9. Contractor is to keep the fire (fire pump, sprinkler, and devices) systems operational at all times until new systems are installed and approved. Temporary service may be required to keep operational.
  10. Contractor to balance the mechanical system for the fourth floor prior to occupancy. Any issues are the responsibility of the contractor to correct so occupancy and TCO can be issued for these areas.
  11. The Contractor is to keep the existing fire alarm system operational on all floors throughout the duration of construction. The contractor is to change all existing smoke devices to heat detectors during construction till the new ceilings, fire devices, and sprinklers are installed and operational. The detectors shall be as high to the deck until the new ceilings are installed and these are no longer required. These shall be programmed into the fire panel and all other existing devices removed as required. The devices are to be programmed into the existing fire alarm panel and tested so there are no troubles on the panel. Once the devices are required to be reinstalled in the new ceilings the heats are to be removed and program changed while the new devices are installed and programmed in the new ceiling. A fire watch shall be required by this contractor when the system is off line at any time.
  12. All the hospital beds, tables, and headboards are to be reuse on the sixth floor. These beds need to be protected and /or stored off site by the contractor until needed. These beds do not fit in the elevator when rolled in.
  13. All the nursing tables are to be reused on the sixth floor. These tables need to be protected and /or stored off site by the contractor until needed.
- D. These special requirements and constraints shall be understood and included in the Contractor's bid proposal for Phase III of the project:
1. Contractor shall install and maintain temporary partitions as needed to keep construction and occupied areas separated. These partitions are to be removed at the completion of Phase III.
  2. All demolition and environmental abatement to be completed from 10:00 PM through 6:30 AM.
  3. All remaining items including but not limited to loose furniture shall be removed and discarded by this Contractor.
  4. Any work required to be done above the 5<sup>th</sup> floor ceilings or any of the occupied areas shall be completed from 10:00 PM through 6:30 AM with prior notifications and approvals.

## **SECTION 01 11 00 – SUMMARY OF WORK**

5. Contractor to keep all utilities operational servicing all the occupied floors throughout Phase III. Contractor is required to install and relocate temporary utilities as required between 10:00 PM and 6:30 AM.
6. Contractor is to provide temporary utility connections as needed until permanent connections can be made if it impacts the occupied areas.
7. Contractor is to keep the fire (fire pump, sprinkler, and devices) systems operational at all times until new systems are installed and approved. Temporary service may be required to keep operational.
8. Contractor to balance the mechanical system for the sixth floor prior to occupancy. Any issues are the responsibility of the contractor to correct so occupancy and TCO can be issued for these areas.
9. The Contractor is to keep the existing fire alarm system operational on all floors throughout the duration of construction. The contractor is to change all existing smoke devices to heat detectors during construction till the new ceilings, fire devices, and sprinklers are installed and operational. The detectors shall be as high to the deck until the new ceilings are installed and these are no longer required. These shall be programmed into the fire panel and all other existing devices removed as required. The devices are to be programmed into the existing fire alarm panel and tested so there are no troubles on the panel. Once the devices are required to be reinstalled in the new ceilings the heats are to be removed and program changed while the new devices are installed and programmed in the new ceiling. A fire watch shall be required by this contractor when the system is off line at any time.

**- END OF SECTION 01 11 00 -**

## SECTION 01 11 05 – TIME OF COMPLETION

### PART 1 - GENERAL

#### 1.1 TIME OF COMPLETION AND SCHEDULING

- A. In preparation of the CPM schedule, the Contractor shall allow for the following activities and durations:
1. The Contractor can anticipate a Notice to Proceed to be issued no later than (21) calendar days after the opening of the bids.
  2. The Contractor can anticipate construction permits being issued by the New Jersey Department of Community Affairs (DCA) no later than (45) calendar days after the Contractor has submitted to NJCU ALL the permit technical applications and required signed/sealed drawings and specifications prepared by the Contractor.
- B. The listed milestone dates represent the Contractor's contractual obligations to the University under this Contract:
1. File for Construction Permits: (7) Calendar days after Notice to Proceed
  2. Issue Submittal Schedule: (15) Calendar days after Notice to Proceed
  3. Issue Schedule of Values: (15) Calendar days after Notice to Proceed
  4. Issue Project CPM Schedule: (30) Calendar days after Notice to Proceed
  5. Furnish All Submittals for Review: (60) Calendar days after Notice to Proceed (Submittals that require field verification and dimensions that cannot be prepared within this period are excluded of this milestone. Submittals required for DCA approval for permits and items with long lead times shall be required prior to this milestone.)
  6. Commence Field Work:
    - a. Phase 1- 5<sup>th</sup> floor field work May 23, 2018
    - b. Phase 2- 4<sup>th</sup> floor field work May 29, 2018
    - c. Phase 3- 6<sup>th</sup> floor field work June 4, 2018
  7. TCO Substantial Completion:
    - a. Phase 1- 5<sup>th</sup> floor July 27, 2018
    - b. Phase 2- 4<sup>th</sup> floor August 17, 2018
    - c. Phase 3- 6<sup>th</sup> floor October 26, 2018

## **SECTION 01 11 05 – TIME OF COMPLETION**

8. Final Completion: (30) calendar days after Substantial Completion for each floor as noted above.
- C. The following are schedule constraints that the Contractor shall adhere to and include in the CPM schedule:
1. The University has final exams from May 9<sup>th</sup> through May 15, 2018. Contractor will be limited to certain construction activities during this period of time (due to noise, vibrations, and/or odors, etc generated by construction activities) as not to impact building occupants during this critical time period at no additional cost to the University.
  2. The University has open house in September, exact date to be determined, and may need to have any dumpsters and outside items removed from the site for this event and all areas cleaned up.
  3. The contractor shall not commence activities until the University has completely moved out of each area required for work to commence.

**- END OF SECTION 01 11 05 -**

## SECTION 01 22 00 - UNIT PRICES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
  - 1. Section 01 26 00 "Contract Modification Procedures" and Supplemental General Conditions for procedures for submitting and handling Change Orders.

#### 1.3 BID FORM SUPPLEMENT

- A. **This form is required to be attached to the Bid Form.**
- B. The undersigned Bidder proposes the amounts below be added to or deducted from the Contract Sum on performance and measurement of the individual items of Work.

#### 1.4 DEFINITIONS

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

#### 1.5 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an

## SECTION 01 22 00 - UNIT PRICES

independent surveyor acceptable to Contractor. If the measurements issued by the contractor are incorrect then the contractor will be charged for the independent surveyor.

- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.
- E. Each Unit prices shall be accepted, rejected, or negotiated prior to contract award to be included in the contract.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 SCHEDULE OF UNIT PRICES

- A. The Bid Form includes specific line items that the Owner requests pricing for, based upon the specified units of measure. The price provided for each item and quantity, used to establish the base bid for the project, shall also be used to establish the contractually agreed-to unit price for any quantity or scope adjustment required for the Duration of the project and contract.

Unit prices shall be used to establish value for proposed change orders to address owner requested changes in the project scope of work or to address unforeseen project conditions.

Unit prices for the following items are solicited on the Bid Form:

UNIT PRICE No. 1: Illuminated Exit Signs. State the total cost per unit to provide and install the specified illuminated exit signs at locations directed by the Owner.

\$\_\_\_\_\_ /exit sign.

UNIT PRICE No. 2: Fire Alarm System Devices. State the total cost per unit to provide and install the specified devices, associated components, and programming at locations directed by the Owner.

- a. Furnish and install smoke detector and base  
\$\_\_\_\_\_ per unit.
- b. Furnish and install pull station and stopper II cover  
\$\_\_\_\_\_ per unit.
- c. Furnish and install strobe  
\$\_\_\_\_\_ per unit.
- d. Furnish and install speaker strobe  
\$\_\_\_\_\_ per unit.

SECTION 01 22 00 - UNIT PRICES

- e. Furnish and install speaker  
\$\_\_\_\_\_ per unit.

3.2 SUBMISSION OF BID SUPPLEMENT

Respectfully submitted this \_\_\_\_ day of \_\_\_\_\_, 2018.

Submitted By: \_\_\_\_\_  
(Insert name of bidding firm or corporation)

Authorized  
Signature: \_\_\_\_\_  
(Handwritten signature)

Signed By: \_\_\_\_\_  
(Type or print name)

Title: \_\_\_\_\_  
(Owner/Partner/President/Vice President)

END OF SECTION 01 22 00

## SECTION 01 23 00 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions and other Division 01 and Technical Specifications, apply to this Section.

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for alternates.

#### 1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the Base Bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
  - 1. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

#### 1.4 PROCEDURES

- A. Coordination: Modify 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.
  - 2. Bidders are required to provide numerical cost amounts for all alternates listed to reflect the cost associated with the Contract being bid. If an alternate bid does not pertain to a particular Contract or if there is no cost associated with the alternate, Bidders may input either "zero" or "no change" in that space.
  - 3. Bidders are required to provide numerical cost amounts for all alternate bids and unit prices listed to reflect the cost associated with the Contract being bid.



## SECTION 01 23 00 - ALTERNATES

- 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 modifications to alternates.
- C. Execute accepted alternates under the same conditions as other work of the Contract.
- D. The University reserves the right to award the Contract upon the basis of a single bid for the entire work. Alternates will be accepted or rejected in numerical sequence as cited in the Bid Documents and shall not be selected at random except as provided herein. Add alternates and deduct alternates will be specified separately. The University may choose from the add and deduct alternates without priority between the two groups so long as selection within each group is in numerical sequence from the first to the last.
- E. Alternate pricing submitted on the bid proposal form shall be held by the Contractor for the duration of the Contract with no increase or decrease in cost if the University elects to execute an alternate during the contract duration.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 SCHEDULE OF ALTERNATES

#### **Alternate #1: Elimination of the Light Box Scope**

State the amount to be “DEDUCTED FROM” the base bid to provide all work and cost associated with the elimination of providing the installation of the Light Box Door Surrounds at the north and south fire stair doors on the corridor side (2 per floor) at the 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> floors. Refer to detail F5 on drawing sheet A-102 for the required construction in lieu of the base bid scope. Note that drawing P16 on drawing sheet A-401 illustrates this condition as an interior elevation.

#### **Alternate #2: Eliminate the Corridor Display Case Renovation Scope**

State the amount to be “DEDUCTED FROM” the base bid to provide all work and cost associated with the elimination of providing the installation of the renovated display case scope illustrated in section details E12 and E8 on drawing sheet A-700. There are two such display cases tagged on the fourth floor on drawing sheet A-101 and five cases tagged on the sixth floor on drawing sheet A-103. In lieu of the renovation scope, the existing cabinets are to remain “as-is”.

#### **Alternate #3: Eliminate the Card Reader/ Access Control Scope**

State the amount to be “DEDUCTED FROM” the base bid to provide all work and cost associated with providing the elimination of the card readers and access control components for door hardware at the sixth floor. Refer to drawing sheet A-900, drawing

## SECTION 01 23 00 - ALTERNATES

D20 Door Schedule for the doors which are scheduled to receive the card reader for this alternate.

### **Alternate #4: Eliminate Fifth Floor Corridor Scope**

State the amount to be “DEDUCTED FROM” the base bid to provide all work and cost associated with providing the elimination of the renovation scope for interior finishes at the fifth floor corridor. All new ceilings, light fixtures, wall finishes, wall-base finishes, and floor finishes are to be eliminated for this alternate. Note that the fire alarm scope and sprinkler scope at the corridors will remain. The intent is to allow the existing corridor finishes to remain.

### **Alternate #5: Eliminate the Baffle Ceiling and Replace with a Conventional 2' x 6' Ceiling**

State the amount to be “DEDUCTED FROM” the base bid to provide all work and cost associated with providing the elimination of the Baffle Ceilings at the fourth and fifth floor corridor ceilings and to replace those finishes with a 2' x 6' ceiling panel system. Refer to drawing A-801 ALT for this scope.

END OF SECTION 01 23 00

## **SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section specifies administrative requirements necessary for contract modification procedures including, but not necessarily limited to:
  - 1. Change Order Proposals.
  - 2. Change Order.

#### **1.2 MINOR CHANGES IN THE WORK**

- A. Architect/CM will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on an approved standard form provided by the Architect/CM.

#### **1.3 CHANGE ORDER PROPOSALS**

- A. Owner-Initiated Proposal Requests: Proposed changes in the Work that will require adjustment to the Contract Sum and/or Contract Time will be issued by the Construction Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
  - 1. Proposal requests issued by the Construction Manager are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change, unless directed specifically to do so.
  - 2. Unless otherwise indicated in the proposal request, within seven (7) calendar days, unless otherwise notes, of receipt of the proposal request, submit to the Construction Manager and architect for review a proposed cost necessary to execute the proposed change. The Contractor and Subcontractors shall use the electronic change order proposal form contained in the Contract Documents section 00 60 03 & 00 60 04 which will also be provided by the Construction Manager in electronic format after contract award.
    - a. Include a list of all labor, equipment, quantities of products to be purchased and unit costs, and indirect costs. Where requested, furnish survey data to substantiate quantities.
    - b. Include all credits.
    - c. Indicate all applicable delivery charges, equipment rental, and amounts of trade discounts.

## **SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES**

- d. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time. If requesting a time extension to the contract, an updated CPM schedule shall be provided justifying the time extension request. Without submission of the CPM schedule, no extension of time will be granted with the change order proposal.
- B. Contractor-Initiated Proposal Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a change order proposal to the Construction Manager and architect. The Contractor must submit the request no later than seven (7) calendar days after the condition is uncovered. The Contractor and Subcontractors shall use the electronic change order proposal form contained in the Contract Documents, as noted above, which will be provided by the Construction Manager after contract award.
1. Include a statement outlining the 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 Contract Time.
  2. Include a list of all labor, equipment, quantities of products to be purchased and unit costs, and indirect costs. Where requested, furnish survey data to substantiate quantities.
  3. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

### **1.4 CHANGE ORDER**

- A. Upon the approval of the Owner, Construction Manager, and Architect, the Construction Manager will prepare and issue a formal Change Order for execution by all parties. This is to be reviewed and signed by the contractor and sent to the architect for signatures who will then send it back to the CM for processing with the Owner.

**- END OF SECTION 01 26 00 -**

## SECTION 01 29 00 – PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section specifies administrative requirements necessary for payment procedures including, but not necessarily limited to:
  - 1. Schedule of Values.
  - 2. Applications for Payment.
  - 3. Attachments to Applications for Payment.

#### 1.2 SCHEDULE OF VALUES

- A. The Contractor shall coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule.
- B. Format and Content: Use the Project Manual Table of Contents (specification sections) as a guide to establish the format for the Schedule of Values.
  - 1. Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect and Construction Manager.
    - c. Contractor's name and address.
    - d. Date of submittal.
    - e. Number of Submittal.
  - 2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
    - a. Generic name.
    - b. Related Specification Section.
    - c. Name of subcontractor.
    - d. Name of manufacturer or fabricator.
    - e. Name of supplier.
    - f. Change Orders (numbers) that have affected value.
    - g. Dollar value.
    - h. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent.
- C. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. At a minimum, the breakdown shall be by building trade, floor, and phase. Break principal subcontract amounts down into multiple line items. Round amounts off to the nearest whole dollar; the total shall equal the Contract Sum.

## **SECTION 01 29 00 – PAYMENT PROCEDURES**

- D. Tabulate schedule of values into subcontracts and trades for each of which the labor, materials, other cost and resulting final cost per line item shall be indicated. Labor, materials, and other cost generally include but are not necessarily limited to the following:
  - 1. Labor; on site labor for the handling and installation of material from point of delivery at site.
  - 2. Material; cost of materials as delivered to the site for installation and erection.
  - 3. Other cost; rental equipment, depreciation, site office, administration, overhead and profit, testing, survey and layout, samples and all other costs not included in labor and material.

### **1.3 APPLICATIONS FOR PAYMENT**

- A. The Contractor's monthly application for payment shall be in the same schedule form as the schedule of values, reflecting the same items.
- B. Each Application for Payment shall be consistent with previous applications and payments as approved by and paid for by the Owner.
  - 1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the final Application for Payment involve additional requirements.
- C. Payment Application Times: The Contractor is to submit a pencil copy on the last day of each month for work completed through that month. The Construction Manager and architect will review and either provide revisions or an approval within seven (7) business days.
- D. Payment Application Forms: Contractor shall use AIA Document G702/CMA and Continuation Sheets G703/CMA as the form for Application for Payment.
- E. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Contractor. Incomplete applications will be returned without action.
  - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions have been made.
  - 2. Include amounts of approved Change Orders issued prior to the last day of the construction period covered by the application. Change Orders shall only be listed if it appears on your updated PO. If it is not listed on your updated PO then it shall not be listed on the application. A copy of the PO shall be issued to the CM for verification when reviewing the pencil copy.
- F. Transmittal: Submit one (1) executed copies of each Application for Payment and two (2) copies of all backup documentation to the Architect.

## SECTION 01 29 00 – PAYMENT PROCEDURES

G. Initial Application for Payment: Administrative actions and submittals that shall precede submittal of the first Application for Payment include the following:

1. List of subcontractors.
2. List of principal suppliers and fabricators.
3. Approved Schedule of Values.
4. Contractor's Construction Schedule.
5. Schedule of Principal Products.
6. Submittal Schedule.
7. List of Contractor's staff assignments.
8. Permit application and technical sections from every contractor.
9. Certificates of insurance and insurance policies.
10. Performance and payment bonds.
11. Site Specific Safety program.
12. QA / QC Program

Without all of the above being submitted and approved the initial payment shall not be reviewed or approved.

H. Final Application for Payment: Administrative actions and submittals that must precede submittal of the final Application for Payment include the following:

1. As-Built drawings.
2. Operation and Maintenance manuals.
3. Training videos.
4. Attic Stock.
5. Special written guarantees and warranties in addition to the one-year guarantee. Guarantee shall be signed and sealed by Officer of the Contracting Firm and shall be notarized.
6. Final Certificate of Occupancy.
7. Final Commissioning report from the Commissioning Agent.

## **SECTION 01 29 00 – PAYMENT PROCEDURES**

### 1.4 ATTACHMENTS TO APPLICATIONS FOR PAYMENT

#### A. Monthly Applications for Payment:

1. Transmittal Letter.
2. Partial Waiver of Lien from Contractor and all Subcontractors and Vendors.
3. NJ State Monthly Project Workforce Report.
4. NJ State Certified Payroll Reports.
5. Monthly Construction Progress Photographs and Videos (on memory stick / flash drive).
6. Updated CPM Schedule.

#### B. Final Application for Payment:

1. Transmittal Letter.
2. Attachment to Application for Payment.
3. AIA Document G706 Affidavit of Payments of Debits and Claims from the Contractor and all Subcontractors.
4. AIA Document G706A Affidavit of Release of Liens from the Contractor and all Subcontractors.
5. AIA Document G707 Consent of Surety to Final Payment.
6. Certification of paid wages in accordance with NJ Prevailing Wage Act from the Contractor and all Subcontractors.
7. Letter from each contractor stating all work has been completed per contract documents and code requirements.

**- END OF SECTION 01 29 00 –**



## **SECTION 01 31 00 – PROJECT ADMINISTRATION**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section specifies administrative and supervisory requirements necessary for Project administration including, but not necessarily limited to:
  - 1. Project Administration.
  - 2. Requests for Information.
  - 3. Contract Award Meeting.
  - 4. Pre-Construction “Kick-Off” Meeting.
  - 5. Pre Installation Meeting.
  - 6. Progress Meetings.

#### **1.2 PROJECT ADMINISTRATION**

- A. All project related correspondence are to be issued to the Construction Manager, with carbon copies to the Architect and/or Engineer. E-Mail communication will be an acceptable means of communication between the Contractor and Construction Manager.

#### **1.3 REQUESTS FOR INFORMATION**

- A. The Contractor is to prepare and submit a Request for Information (RFI) to the Construction Manager and Architect for action when a clarification and/or additional information is required to perform an activity of work. The RFI is to be submitted on a word or excel document along with any back-up required.
- B. The request must include date, title, a drawing and/or specification reference when applicable and must also include a proposed solution for review by the Architect. Requests not provided with a recommended solution, if applicable, will be returned to the Contractor with no action until such recommendation is provided.
- C. The request must include any cost or schedule impacts. If there are schedule impacts the schedule shall be updated and issued and costs shall have a detailed request to change order on the required forms.
- D. The Construction Manager and Architect will endeavor to respond to requests in a timely manner so not to impact onsite activity. It is the Contractor’s responsibility to review the Contract Documents thoroughly for planned work and submit a request with sufficient time for the Construction Manager and Architect to review and respond. If the Contractor fails to carry out this responsibility, The Contractor will not be entitled to an extension of time and/or additional incurred costs should the request impact construction progress.

## **SECTION 01 31 00 – PROJECT ADMINISTRATION**

### **1.4 CONTRACT AWARD MEETING**

- A. The Construction Manager shall schedule a contract award meeting at the Project site no later than seven (7) calendar days after issuance of the Notice to Proceed and prior to commencement of construction activities. Topics of discussion are to include, but not limited to:
1. Contract Documents.
  2. Summary of work.
  3. Time of completion.
  4. Conditions of the Contract.
  5. Contract execution.
  6. Review Contract submittals and timelines.
  7. Phasing.
  8. Building Occupants and Hours of Operation.

### **1.5 PRE-CONSTRUCTION “KICK-OFF” MEETING**

- B. The Construction Manager will schedule and conduct an initial Pre-Construction Meeting. The Contractor shall have in attendance all staff that will be involved in the project. Attendees must include staff responsible for field construction oversight, project management, submittals, requests for information, applications for payment, etc. Topics of discussion are to include, but not limited to:
1. Project team assignments.
  2. Communication protocols.
  3. Contract modification procedures and forms.
  4. Payment procedures and forms.
  5. Project administration.
  6. CPM scheduling requirements.
  7. Submittal procedures.
  8. Quality requirements.
  9. Code inspection procedures.
  10. Contractor’s safety plan and requirements.
  11. Set progress meeting day and time.

## **SECTION 01 31 00 – PROJECT ADMINISTRATION**

12. Requirements for daily hot work and red tag permits.
13. Procedure for daily disabling of fire detection systems.
14. Notice procedure for disruption of utilities.

### **1.6 PRE INSTALLATION MEETING**

C. The Contractor shall conduct a pre installation meeting at the site before each major construction activity commences. The Contractor, Subcontractors, 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. The Contractor is to schedule these meetings at least two (2) weeks prior to the construction activity commences. Topics of discussion are to include, but not limited to:

1. Shop Drawings, Product Data and quality control Samples.
2. Possible conflicts.
3. Compatibility problems.
4. Time schedules.
5. Weather limitations.
6. Manufacturer's recommendations.
7. Compatibility of materials.
8. Acceptability of substrates.
9. Temporary facilities.
10. Space and access limitations.
11. Governing regulations.
12. Safety.
13. Inspection and testing requirements.
14. Required performance results.
15. Recording requirements.
16. Protection.

## **SECTION 01 31 00 – PROJECT ADMINISTRATION**

### **1.7 PROGRESS MEETINGS**

- A. The Construction Manager will conduct progress meetings at the Project site bi-weekly (weekly meetings maybe necessary at points in the project as directed by the Construction Manager), and shall record results of meetings and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting. The project meetings are to be held in the contractor's field office where all the updated documents are being kept and maintained.
- B. Attendees: Attendees are to include the Construction Manager, Architect and/or Engineer, and Contractor. The Contractor shall be represented as a minimum by the field superintendent and project manager. At times and as requested, the Contractor shall make available the scheduler, and/or any subcontractors to attend these meetings.
- C. Agenda: Review items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project such as:
  - 1. Permitting and code inspections.
  - 2. Requests for information.
  - 3. Submittals.
  - 4. Material/equipment fabrication and delivery.
  - 5. Schedule update.
  - 6. Field observations.
  - 7. General discussion.
  - 8. Contract administration.
  - 9. Safety.
- D. Reporting: No later than seven (7) business days after each progress meeting date, the Construction Manager shall distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

**- END OF SECTION 01 31 00 -**

## **SECTION 01 32 00 – CPM SCHEDULING REQUIREMENTS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section specifies administrative and procedural requirements for CPM scheduling.

#### **1.2 GENERAL REQUIREMENTS**

- A. The Work under this Contract will be planned, scheduled, executed and reported using the Critical Path Method (CPM).
- B. The Contractor shall develop the CPM schedule using Primavera schedule software (P6). No other scheduling software will be permitted.
- C. The Contractor shall provide all information and input required for development of the schedule for the Work according to the requirements of this Section. The purpose of the project schedule shall be to:
  - 1. Assure adequate planning, scheduling and reporting during execution of the contract;
  - 2. Assure coordination of the Work of the Contractor and Subcontractors;
  - 3. Assist the Contractor and the Construction Manager in monitoring the progress of the Work and evaluating the time and cost impact, if any, of proposed changes to the Contract and the project schedule;
  - 4. Assist the Contractor and Construction Manager in the preparation and evaluation of the Contractor's monthly progress payments.
- D. The Contractor shall involve all applicable Subcontractors in the schedule development, updating, and revisions, as required.
- E. The Contractor understands and agrees that the schedule is intended to accurately reflect at all times the status of the Work. The Contractor also understands and agrees that changes or revisions to the schedule are key components of this requirement and will make every reasonable effort so that the schedule accurately reflects current conditions.
- F. The Contractor shall maintain staff onsite that is knowledgeable in preparing input information for the schedule, monitoring progress, updating and revising schedules when necessary. The Contractor shall identify the individual(s) on its staff who will be responsible for scheduling efforts.
- G. If the Contractor does not possess on-staff scheduling capabilities sufficient to comply with the requirements of this Section, the Contractor shall identify the firm and individual within the firm who will be retained to provide the required expertise.

## SECTION 01 32 00 – CPM SCHEDULING REQUIREMENTS

- H. Failure to furnish any required submittal or information specified herein shall constitute a cause for withholding any progress payment.

### 1.3 SCHEDULE REQUIREMENTS

- A. Within 30 calendar days of the Notice to Proceed, the Contractor shall submit to the Construction Manager for review and acceptance, a CPM schedule utilizing precedence diagramming method for procurement and construction work scope. The CPM schedule shall provide a complete and detailed sequence of operations of the Work within the time limits in the Contract.
- B. The CPM schedule shall include:
  - 1. All activities necessary to account for the full scope of work.
  - 2. The order and interdependencies of the Contractor's activities and the interface or interrelation with the activities of others. The following criteria shall form the basis for assembly of the logic relationships:
    - a. What activity must be completed before a subsequent activity can be started?
    - b. What activities can be done concurrently? This includes activities with Start-To-Start and Finish-To-Finish relationships with or without leads and lags.
  - 3. A single critical path that runs through the entire CPM schedule beginning with the first activity, e.g., Notice to Proceed, and ending with the last activity, e.g., Project Complete.
  - 4. Conformance with and identification of the specific milestone or completion dates specified in the Contract Documents.
  - 5. Off-site activities: The Contractor shall include in the CPM schedule all procurement activities which lead to the delivery of materials to the site and logically tie the material delivery to the related construction activity. The off-site activities shall include the following:
    - a. Ordering, submittals, manufacturing or fabricating, and delivery of equipment and materials. Long lead items requiring more than one month between ordering and delivery to the site shall be clearly noted.
    - b. All significant Contractor activities during the fabrication and erection/installation in a Contractor's plant or on a job site, including materials/equipment purchasing, and delivery.
    - c. Contractor's drawings and submittals to be prepared and submitted to the Architect.
    - d. Approval of Contractor submittals by the Architect, which shall be a maximum of (21) calendar days.
  - 6. Delivery of Owner furnished material and equipment.
  - 7. Testing and commissioning of equipment, systems and materials.
  - 8. Required state inspections.
  - 9. Project closeout activities.

## SECTION 01 32 00 – CPM SCHEDULING REQUIREMENTS

- C. The identity, duration, and logic of activities comprising the CPM schedule shall meet the following criteria:
1. Activity boundaries shall be easily measurable and descriptions shall be clear and concise. Do not preface activity descriptions with “Begin” or “Complete.” The beginning and end of each activity shall be readily verifiable, and progress should be quantifiable. Do not reference percentage completion within the activity description.
  2. Activity codes necessary to better organize the schedule, including but not limited to, a responsibility code for each activity that shall identify an activity with a single performing organization.
  3. The calendar shall account for all holidays, shutdown periods for weather sensitive work, etc.
  4. Seasonal weather conditions, utility coordination, no-work periods, expected job learning curves, and other foreseeable delays to activities shall be considered and included within the developed duration for each activity affected.
  5. “Start To Start” and “Finish-To- Finish” activity relationships shall be minimized. The preferred relationship type is “Finish-To-Start” with zero lag. Do not use “Start-To-Finish” relationship types. The use of negative lag is also prohibited. The use of “Finish-To-Finish” relationships, only, is prohibited. Where “Start-To-Start” relationships are used between activities, “Finish-To-Finish” relationships must also be used between those same activities. There should be no activities where the finish of one activity is not tied to another activity.
  6. Imposed completion dates for events other than the specified milestones or completion dates will not be permitted.
- D. The level of detail of the CPM schedule shall be such that no activity duration shall be over (30) calendar days, except for non-construction activities such as shop drawing and sample submittals, fabrication and delivery of materials and equipment, and delivery of equipment.
- E. The CPM schedule shall not show an early completion date for the project later than the project’s required completion date.
- F. The Owner does not guarantee that the Contractor can start work activities on the “Early Start” or “Late Start” dates or complete work activities on the “Early Finish” or “Late Finish” date shown in the initial schedule submission, or in an updated or revised schedule; nor does the Owner or Construction Manager guarantee that the Contractor can always proceed in the sequence established by said schedule. If Contractor’s schedule shows that the Owner or a separate contractor is to complete an activity by a specific date, or within a certain duration, the Owner or any separate contractor under contract with the Owner shall not be bound to said date or duration unless the Owner expressly and specifically agrees in writing to same; the Owner’s, the Construction Manager’s and/or Architect’s review and acceptance of the schedule does not constitute an agreement to the specific dates, durations, or sequences for activities of the Owner or any separate contractor.

## SECTION 01 32 00 – CPM SCHEDULING REQUIREMENTS

- G. The submittal of the contract scheduling documents for the baseline and subsequent updates shall include:
1. Electronic copy in Primavera .XER format
  2. Written narrative of construction progress to include, as a minimum, activities completed, activities started, and activities ongoing. Narrative to also include any impacts to construction progress and methods to eliminate said impacts.
  3. 11 x 17 Gantt Chart report in color to include, as a minimum, activity ID's, activity descriptions, early and late start and finish dates, percent complete, and total float. The reports shall be sorted by:
    - a. Activity ID
    - b. Early Start, Early Finish
    - c. Total Float

### 1.4 APPROVAL PROCESS

- A. The Construction Manager will review the Contractor's schedule, including logic diagrams and computer generated analysis for compliance with the provisions of this Section as well as the requirements of the Contract as a whole. The Construction Manager shall have (14) calendar days to review and comment on (or accept) in writing the Contractor's schedule submission.
- B. The Contractor shall revise and resubmit the schedule within (7) calendar days. The Construction Manager will have (7) calendar days to review and comment on (or accept) in writing the Contractor's revised schedule.
- C. Within (3) calendar days following final acceptance of the schedule, the Contractor shall provide copies of the CPM schedule to the Construction Manager in accordance with this Section.
- D. Upon final acceptance, the schedule will become the official project schedule and will be used to monitor progress of the Work, subject to such revisions made to the schedule as provided for herein or in the Contract Documents, and to support requests for payment.
- E. Acceptance by the Construction Manager of the Contractor's CPM schedule shall not relieve the Contractor of the responsibility for accomplishing the Work within every contract required milestone and completion date. The Owner and Construction Manager disclaim any obligation or liability due to acceptance of the CPM schedule.

### 1.5 SCHEDULE UPDATES

- A. Schedule updates shall be prepared each month with progress reported through the 24<sup>th</sup> day of the month and submitted with the payment applications for review by the Construction Manager on the last day of each month. Upon review and acceptance by the Construction Manager, the final schedule update shall be submitted with the final payment application on the first weekday of the next month.



## SECTION 01 32 00 – CPM SCHEDULING REQUIREMENTS

- B. The progress report submitted by the Contractor will indicate, as a minimum, those activities, or portions of activities, which were completed during the reporting period, the actual start and finish dates for those activities, remaining duration and/or estimated percent complete for activities currently in progress.

Starting (30) calendar days after the start of construction, and throughout the progress of the Work, the Contractor shall prepare and maintain a two week look-ahead schedule reflecting schedule of work activities (from the CPM schedule) actually accomplished for the previous week and the work scheduled for the forthcoming two weeks. This look-ahead schedule shall be prepared on a weekly basis and issued to the Construction Manager.

### 1.6 SCHEDULE REVISIONS

- A. Should the Contractor, after acceptance of the initial CPM schedule, want to change its plan of construction, the Contractor shall submit the requested revisions to the Construction Manager including a written description of the reason for rescheduling the Work, and methods of maintaining adherence to milestone and specific dates. The Construction Manager will have (7) calendar days to review and either accept or reject the reason for the revised schedule in writing to the Contractor. If the Contractor's requested schedule revision is accepted by the Construction Manager, the changes will be incorporated by the Contractor into the CPM schedule in the next schedule update and will become the new project schedule.
- B. The Contractor shall revise the schedule to include the effect of changes or other conditions or events that have affected the CPM schedule. The Construction Manager will have (7) calendar days to review and either accept or reject the reason for the revised schedule in writing to the Contractor. If the Contractor's requested schedule revision is accepted by the Construction Manager, the changes will be incorporated by the Contractor into the CPM schedule in the next schedule update and will become the new project schedule.
- C. When the Construction Manager directs changes by Change Order that have the potential to impact the Contract milestones or completion dates, a schedule fragnet shall be prepared by the Contractor and provided to the Construction Manager as part of the Change Order Proposal. If the Contractor has prepared a scheduled fragnet that results in a time extension request, the Contractor must identify to the Construction Manager as part of the Change Order Proposal the cost to buy back time to allow the Owner the option of granting a time extension or buying back the time. If the Construction Manager accepts the schedule fragnet, it will be incorporated into the CPM schedule by the Contractor during the next schedule update.
- D. Should any of the conditions exist, such that certain activities shown on the Contractor's CPM schedule fall behind schedule to the extent that any of the specific milestone or completion dates are in jeopardy, the Contractor may be required when directed, to prepare and submit to the Construction Manager, a recovery schedule and written narrative explaining how the Contractor intends to reschedule the Work to regain compliance with the accepted CPM schedule. The preparation of a recovery schedule shall not be grounds for a Change Order or a time extension unless the Contractor can conclusively establish that the Owner is solely responsible for the schedule slippage. In no event shall Contractor refuse or fail to revise the schedule based on claimed Owner delays or lack of information. In such cases, Contractor shall apply its best efforts and apply reasonable assumptions when information is alleged to be lacking.

## **SECTION 01 32 00 – CPM SCHEDULING REQUIREMENTS**

- E. The Contractor shall do the following, after determination of the requirement for a recovery schedule:
1. Within (5) calendar days of being directed to provide a recovery schedule, the Contractor shall submit the recovery schedule, and written narrative of how the Contractor intends to recover the time, for acceptance to the Construction Manager. The recovery schedule shall be prepared to similar level of detail as the accepted CPM schedule and shall address how the Contractor intends to recover the time. The Construction Manager will have (5) calendar days to review and comment on the recovery schedule.
  2. Any revisions necessary because of this review shall be resubmitted by the Contractor for acceptance within (3) calendar days. The accepted recovery schedule shall then be the schedule that the Contractor shall use in planning, organizing, directing, coordinating, performing and executing the Work (including all activities of subcontractors) to regain compliance with the CPM schedule.
  3. Typical methods of revising the schedule to recover time include, but are not limited to:
    - a. Reducing the durations of activities not yet started.
    - b. Changing schedule logic, e.g. changing “Finish-To-Start” relationships to “Start-To-Start” relationships, using negative lags, etc.
    - c. Changing the method of schedule calculation from retained logic to progress override.
  4. If at any time during the construction, it appears to the Construction Manager that the Contractor’s schedule no longer represents the actual prosecution and progress of the Work, the Construction Manager will request in writing a revision to the schedule. Any “out of sequence progress” problems will be considered evidence that the schedule needs revising. The Contractor then has (5) calendar days to respond to that written request.

**- END OF SECTION 01 32 00 -**

## SECTION 01 32 20 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Daily construction reports.
  - 2. Field condition reports.
- B. See Division 01 Section 01 32 33 "Photographic Documentation" for submitting construction photographs.
- C. Daily Construction Reports: Submit one (1) electronic copy daily to the CM.
- D. Field Condition Reports: Submit two (2) hard copies or one (1) electronic copy at time of discovery of differing conditions to the CM and A/E.

### PART 2 - PRODUCTS

#### 2.1 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site (reports shall be emailed daily to CM or payments shall not be processed):
  - 1. List of subcontractors at Project site, detailing manpower.
  - 2. List of contractor's manpower on-site.
  - 3. Equipment at Project site, including deliveries and removals.
  - 4. Material deliveries.
  - 5. High and low temperatures and general weather conditions.
  - 6. Accidents.
  - 7. Stoppages, delays, shortages, and losses.
  - 8. Meter readings and similar recordings.
  - 9. Orders and requests of authorities having jurisdiction.
  - 10. Services connected and disconnected.
  - 11. Equipment or system tests and startups.
  - 12. Inspections.
  - 13. Directives issued.
  - 14. Schedule activities commencing and completing.
  - 15. Meetings held.
  - 16. Visitors on site.
  - 17. Progress photos.
- B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report to the CM and A/E. Submit with a request for information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

END OF SECTION 01 32 20

## 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.
  - 4. Preconstruction video recordings.
  - 5. Periodic construction video recordings.
  - 6. Training video recordings.
  - 7. Web-based construction photographic documentation.
- B. Related Requirements:
  - 1. Section 01 32 20 "Const Progress Documentation"
  - 2. Section 01 33 00 "Submittal Procedures" for submitting photographic documentation.
  - 3. Section 01 70 00 "Closeout Procedures" for submitting photographic documentation as project record documents at Project closeout.
  - 4. Section 01 80 00 "Facility Operation" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

#### 1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For videographer.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.
- C. Digital Photographs: Submit image files with each application for payment and in daily reports.
  - 1. Digital Camera: Minimum sensor resolution of 8 megapixels.
  - 2. Format: Minimum 3200 by 2400 pixels, in unaltered original files, with same aspect ratio as the sensor, uncropped, date and time stamped that must appear on the image, in folder named by date of photograph, accompanied by key plan file.
  - 3. Note that not all digital cameras provide the functionality for date stamping, date stamping is a requirement of this Contract.

## SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

4. 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 Construction Manager.
  - 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.

D. Construction Photographs: Submit at least 50 daily construction photographs with each Application for Payment that are representative of the work performed that period.

1. Format: Digital image on thumb drive, thumb drive to be issued to CM and not returned
2. Identification: Title of digital image is to include:
  - a. Date photograph was taken.
  - b. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - c. Example: 2017-10-20\_5<sup>th</sup>\_FI\_510

E. Video Recordings: Submit video recordings within seven (7) days of recording.

1. Submit video recordings in digital video disc format acceptable to Owner.
2. Identification: With each submittal, provide the following information:
  - a. Name of Project.
  - b. Name and address of photographer.
  - c. Name of Architect and Construction Manager.
  - d. Name of Contractor.
  - e. Date video recording was recorded.
  - f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
  - g. Weather conditions at time of recording.
3. Transcript: Prepared on 8-1/2-by-11-inch paper, punched and bound in heavy-duty, three-ring, vinyl-covered binders. Mark appropriate identification on front and spine of each binder. Include a cover sheet with same label information as corresponding video recording. Include name of Project and date of video recording on each page.

### 1.4 USAGE RIGHTS

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

## SECTION 01 32 33 - 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 8 megapixels, and at an image resolution of not less than 3200 by 2400 pixels.
- B. Digital Video Recordings: Provide high-resolution, digital video disc in format acceptable to Owner.

### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION PHOTOGRAPHS

- A. 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. Photos are to be throughout the payment period and not all on the same day.
  - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. 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, which shall also be stamped on the photos.
  - 2. Field Office Images: Maintain one (1) 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 and Construction Manager.
- C. 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 Construction Manager.
  - 1. Flag construction limits before taking construction photographs.
  - 2. Take photographs of all areas and adjacent areas prior to the start of construction.
- D. Periodic Construction Photographs: Take minimum of 50 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.
- E. Final Completion Construction Photographs: Take minimum of 50 color photographs after date of Substantial Completion for submission as project record documents. Construction Manager will inform your professional photographer of desired vantage points, this is to be done at substantial completion of each phase.

## SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

### 3.2 CONSTRUCTION VIDEO RECORDINGS

- A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.
- B. Recording: Mount camera on tripod before starting recording unless otherwise necessary to show area of construction. Display continuous running time and date. At start of each video recording, record weather conditions from local newspaper or television and the actual temperature reading at Project site.
- C. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
  - 1. Confirm date and time at beginning and end of recording.
  - 2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.
- D. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.
- E. Preconstruction Videos: Before starting construction, take videos of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
  - 1. Flag construction limits before taking construction videos.
  - 2. Videos to show existing conditions to adjacent to properties/buildings before starting the Work.
  - 3. Take videos of each existing building and sites either on or adjoining property to accurately record physical conditions inside and outside prior to the start of construction.
  - 4. Take additional videos as required to record settlement or cracking of adjacent structures, pavements, and improvements.
- F. This section also applies to requirements for training. All training shall be professionally videotaped.

- END OF SECTION 01 32 33 -

## **SECTION 01 33 00 – SUBMITTAL PROCEDURES**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
1. Submittal Procedures.
  2. Submittal schedule.
  3. Shop Drawings.
  4. Product Data.
  5. Samples.
  6. Mockups.
  7. Material Safety Data Sheets.

#### **1.2 SUBMITTAL PROCEDURES**

- A. Shop drawings, product data and samples will not be processed by the Architect until the submittal schedule and a list of subcontractors, material suppliers, and fabricators are submitted as required.
- B. If the submittal deviates from the requirements of the Project or the Contract Documents, then the Contractor shall include a cover page, see section 00 60 05, on such submittal that clearly identifies how such submittal deviates from the requirements of the Project or the Contract Documents and briefly identifies why such deviation is appropriate. Substitutions are only allowed during the bidding phase unless item is no longer available.
- C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.



## SECTION 01 33 00 – SUBMITTAL PROCEDURES

- D. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for re-submittals.
- a. Allow two (2) weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Architect will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
  - b. If an intermediate submittal is necessary, process the same as the initial submittal.
  - c. Allow two (2) weeks for reprocessing each revised/reissued submittals.
  - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- E. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  2. Include the following information on the label for processing and recording action taken.
    - a. Project name.
    - b. Date.
    - c. Name, phone number, and address of Architect.
    - d. Name, phone number, and address of Contractor.
    - e. Name, phone number, and address of subcontractor.
    - f. Name, phone number, and address of supplier.
    - g. Name of manufacturer.
    - h. Number and title of appropriate Specification Section.
    - i. Drawing number and detail references, as appropriate.
    - j. Submittal number and revision.
- F. Submittal Transmittal: Package each submittal by specification section and per the master submittal log issued by the Construction Manager. Submittals are to be packaged individually, not grouped. Each submittal shall be transmitted with a cover letter. The cover letter shall identify the following information:
1. Submittal identification number. Numbering system shall be as follows:
    - a. Specification identifier-submittal # within specification-revision  
(Example: 077100-001-01) These numbers will be on the master submittal log and shall be used by all parties.
  2. Specification Section and article number
  3. Type of submittal, e.g. shop drawing, product data, sample, material certification, etc.
  4. Manufacturer and/or fabricator
  5. Product lead time
  6. Include Contractor's certification that information complies with Contract Document requirements.

## SECTION 01 33 00 – SUBMITTAL PROCEDURES

- G. Submittal Distribution: The Contractor shall send all submittals electronically to the attention of the Architect and Construction Manager with a hard copy of large scale or plans larger than 8 ½” x 11” submitted to the Construction Manager. All submittals for the fire protection, plumbing, mechanical, and electrical systems shall also be sent electronically to the Engineer(s) and Commissioning Agent (if required to do so). The Architect will return all submittals electronically directly to the Construction Manager and Contractor. The Contractor shall provide a full size colored hard copy of the returned, approved, submittals to the Construction Manager within one (1) week of receipt but in all cases prior to the material being delivered to the site. Should the Contractor wish to transmit hard copies of the submittal to the Architect, the Contractor shall be responsible for all printing and postage costs to and from the Architect. Contractor is responsible for all printing and distribution to all interested subcontractors and suppliers.

### 1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedules shall be prepared and incorporated into the Contractor’s Construction Schedule. The Contractor shall include the following considerations when preparing the submittal schedule so that approved products are at the project site ready for installation in accordance with the time established in the Contractor’s Construction Schedule to avoid delays.
1. Time frame when the item is needed at the Project.
  2. Time necessary to produce the product.
  3. Lead time required to prepare the submittal.
  4. Time required for the Contractor to review, approve, sign and date the submittal.
  5. Time for the Construction Manager, the Architect and his Engineer to review the submittal.
  6. The number of Subcontractor’s affected by the information contained in the submittal.
  7. Time necessary to correct and resubmit if original submittal is not approved.
  8. Submittal of all color samples within adequate time for review, selection and coordination with other products requiring earlier installation and/or longer lead times for ordering.
  9. Grouping of related submittals for coordination.
- B. Prepare the schedule in chronological order to include all submittals required for the Project and submit to the Construction Manager no later than (20) calendar days after the Notice to Proceed is issued. Provide the following information:
- a. Scheduled date for the first submittal.
  - b. Related Section number.
  - c. Submittal category.
  - d. Name of subcontractor.
  - e. Description of the part of the Work covered.

## SECTION 01 33 00 – SUBMITTAL PROCEDURES

- C. Distribution: Following response to initial submittal, print and distribute copies to the Architect and Construction Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.
- D. Schedule Updating: Revise the schedule after each meeting or activity, where revisions have been recognized or made. Issue the updated schedule concurrently with report of each meeting.
- E. Time Deadline: Refer to specification section 01 11 05 Time of Completion for the deadline of when all submittals are required to be submitted. This shall be incorporated into the submittal schedule.

### 1.4 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered Shop Drawings.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
  - 1. Dimensions.
  - 2. Identification of products and materials included.
  - 3. Compliance with specified standards.
  - 4. Notation of coordination requirements.
  - 5. Notation of dimensions established by field measurement.
  - 6. Sheet Size: Except for templates, patterns and similar full- size Drawings, submit Shop Drawings on sheets at least 8-1/2" x 11" but no larger than 36" x 48".
  - 7. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connection with construction.

### 1.5 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, color charts, rough-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as "Shop Drawings."
  - 1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:

## SECTION 01 33 00 – SUBMITTAL PROCEDURES

- a. Manufacturer's printed recommendations.
- b. Compliance with recognized trade association standards.
- c. Compliance with recognized testing agency standards.
- d. Application of testing agency labels and seals.
- e. Notation of dimensions verified by field measurement.
- f. Notation of coordination requirements.

### 1.6 SAMPLES

- A. Submit three (3) full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture and pattern.
  1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Include the following:
    - a. Generic description of the Sample.
    - b. Sample source.
    - c. Product name or name of manufacturer.
    - d. Compliance with recognized standards.
    - e. Availability and delivery time.
  2. Submit Samples for review of kind, color, pattern, and texture, for a final check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    - a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
    - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, color selection, operation and similar construction characteristics.
  3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of choices, submit a full set of choices for the material or product.
    - a. Preliminary submittals will be reviewed and returned with the Architect's mark indicating selection and other action.
  4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
  5. Maintain sets of Samples, as returned, at the Project site, for quality comparisons throughout the course of construction.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
    - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

## SECTION 01 33 00 – SUBMITTAL PROCEDURES

- B. 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.
  - 1. Field Samples specified in individual Sections are special types of Samples. Field Samples 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.
    - a. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

### 1.7 MOCKUPS

- A. Installation progress of mock ups specified or identified on the drawings shall be addressed by the Contractor at periodic meetings. Provide a separate schedule sheet for each mock up with dates for installation to begin, installation complete, Owner/Architect review period (21 calendar days), punch list corrections, and mock up acceptance. Mock-ups shall be scheduled sufficiently in advance of fabrication of building components to allow review comments by the Construction Manager and Architect to be incorporated into the final product. Mock ups shall be clearly marked and remain undisturbed and accessible as the criteria against which the remaining work shall be judged. Unless otherwise indicated, mockups of exterior wall conditions are to be constructed on grade (not on the building) with foundation and structural support systems engineered by the Contractor. The mockup of the laboratory casework and fittings is to be built off site in a location to be determined by the Contractor in consultation and approval of the Construction Manager.
- B. Provide shop drawings indicating mockup size, proposed materials, and colors. Locations and orientation of all mockups shall be reviewed and approved by the Construction Manager and Architect prior to erection of the mockup. Mockups of interior conditions shall have the scheduled lighting fixtures installed, or the equivalent temporary lighting, during the review and approval period. Installation methods, environmental conditions and other contractor employed means and methods for installing the mock up may be observed by the Architect and shall be employed and maintained in all remaining work.

### 1.8 MATERIAL SAFETY DATA SHEET

- A. Submit material safety data sheets for every product to be utilized for the Project. The MSDS shall be submitted with the product submittal. The Contractor will not be permitted to use or install any products until the proper MSDS is submitted to the Construction Manager. The contractor shall keep a separate binder with divider sheets per spec section in his field office and in the Construction Mangers field office of all MSDS sheets required for the project. These sheets shall be in the binders prior to the material being delivered to the site.

- END OF SECTION 01 33 00 -

## SECTION 01 40 00 – QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for quality control services.
- B. Quality control services include inspections and tests and related actions including reports, performed by independent agencies, governing authorities, and the Contractor. They do not include Contract enforcement activities performed by the Architect or Construction Manager. Inspections and tests will include, but not limited to:
  - 1. Soil analysis.
  - 2. Foundation subgrade compaction.
  - 3. Concrete reinforcing.
  - 4. Concrete strength.
  - 5. Structural steel bolting, shear bolts, welding.
  - 6. Backfill compaction.
  - 7. Roadway subgrade compaction.
  - 8. Asphalt.
  - 9. Fireproofing
- C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with Contract Document requirements.
- D. Requirements of this Section relate to customized fabrication and installation procedures, not production of standard products.
  - 1. Specific quality control requirements for individual construction activities are specified in the Sections that specify those activities. Those requirements, including inspections and tests, cover production of standard products as well as customized fabrication and installation procedures.
  - 2. Inspections, test and related actions specified are not intended to limit the Contractor's quality control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for the Contractor to provide quality control services required by the Architect, Construction Manager or Owner, or authorities having jurisdiction are not limited by provisions of this Section.

## SECTION 01 40 00 – QUALITY REQUIREMENTS

### 1.2 RESPONSIBILITIES

- A. **Contractor Responsibilities:** The Owner shall provide inspections, tests and similar quality control services, specified in individual Specification Sections and required by governing authorities, except where they are specifically indicated to be the Contractor's responsibility, or are provided by another identified entity; these services include those specified to be performed by an independent agency and not by the Contractor.
1. The Owner shall employ and pay an independent agency, to perform specified quality control services.
  2. **Retesting:** The Contractor is responsible for retesting costs where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance with Contract Document requirements, regardless of whether the original test was the Contractor's responsibility.
    - a. Cost of retesting construction revised or replaced by the Contractor is the Contractor's responsibility.
  3. **Associated Services:** The Contractor shall cooperate with agencies performing required inspections, tests and similar services and provide reasonable auxiliary services as requested. Notify the Construction Manager/agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to:
    - a. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests.
    - b. Taking adequate quantities of representative samples of materials that require testing or assisting the agency in taking samples.
    - c. Providing facilities for storage and curing of test samples, and delivery of samples to testing laboratories.
    - d. Security and protection of samples and test equipment at the Project site.
    - e. Provide the latest approved plans, shop drawings, and specifications as required.
    - f. Provide lifts and/or ladders if necessary.
- B. **Duties of the Testing Agency:** The independent testing agency engaged to perform inspections, sampling and testing of materials and construction specified in individual Specification Sections shall cooperate with the Construction Manager and Contractor in performance of its duties, and shall provide qualified personnel to perform required inspections and tests.
1. The agency shall notify the Construction Manager and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  2. The agency is not authorized to release, revoke, alter or enlarge requirements of the Contract Documents, or approve or accept any portion of the Work.
  3. The agency shall not perform any duties of the Contractor.
- C. **Coordination:** The Contractor and each agency engaged to perform inspections, tests and similar services shall coordinate the sequence of activities to accommodate required services with a minimum of delay. In addition the Contractor and each agency shall coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

## SECTION 01 40 00 – QUALITY REQUIREMENTS

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples and similar activities.

### 1.3 SUBMITTALS

- A. The Construction Manager shall submit a certified written report of each inspection, test or similar service, to the Contractor, in duplicate, unless the Contractor is responsible for the service. If the Contractor is responsible for the service, submit a certified written report of each inspection, test or similar service through the Contractor, in duplicate.

1. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
2. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to:
  - a. Date of issue.
  - b. Project title and number.
  - c. Name, address and telephone number of testing agency.
  - d. Dates and locations of samples and tests or inspections.
  - e. Names of individuals making the inspection or test.
  - f. Designation of the Work and test method.
  - g. Identification of product and Specification Section.
  - h. Complete inspection or test data.
  - i. Test results and an interpretation of test results.
  - j. Location of sample or test in project.
  - k. Ambient conditions at the time of sample-taking and testing.
  - l. Comments or professional opinion as to whether inspected or tested Work complies with Contract Document requirements.
  - m. Name and signature of laboratory inspector.
  - n. Recommendations on retesting.

### 1.4 QUALITY ASSURANCE

- A. Qualification for Service Agencies: The Owner will engage inspection and testing service agencies, including independent testing laboratories, which are prequalified as complying with "Recommended Requirements for Independent Laboratory Qualification" by the American Council of Independent Laboratories, and which specialize in the types of inspections and tests to be performed.
  1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the State in which the Project is located.



## **SECTION 01 40 00 – QUALITY REQUIREMENTS**

### **1.5 TRADESMEN & WORKMANSHIP**

- A. Ensure that tradesmen performing work at site are skilled and knowledgeable in methods and craftsmanship needed to produce required quality levels for workmanship in completed work. Remove and replace work which does not comply with workmanship standards as specified and as recognized in the construction industry for applications indicated. Remove and replace other work damaged or deteriorated by faulty workmanship or its replacement.

### **1.6 REPAIR AND PROTECTION**

- A. General: Upon completion of inspection, testing, sample-taking and similar services, repair damaged construction and restore substrates and finishes to eliminate deficiencies, including deficiencies in visual qualities of exposed finishes. Comply with Contract Document requirements for "Cutting and Patching."
- B. Protect construction exposed by or for quality control service activities, and protect repaired construction.
- C. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

### **1.7 REPLACEMENT OF WORK**

- A. Within 24 hours after rejection of work pursuant to the General Conditions, remove all materials and equipment that are rejected and immediately replace work, at the Contractor's cost, to the satisfaction of the Architect and Construction Manager. Should the work of the Owner or other Contractors be damaged by such removal or replacement, the Contractor shall reimburse the Owner or other Contractors for all costs incurred for correcting damage.

**- END OF SECTION 01 40 00 -**

## SECTION 01 42 19 – REFERENCE STANDARDS AND DEFINITIONS

### PART 1 - GENERAL

#### 1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term "indicated" refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as "shown," "noted," "scheduled," and "specified" are used, it is to help the reader locate the reference; no limitation on location is intended.
- C. Directed: Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by the Architect and/or Construction Manager," "requested by the Architect," and similar phrases.
- D. Approve: The term "approved," where used in conjunction with the Architect's and/or Construction Manager's action on the Contractor's submittals, applications, and requests, is limited to the Architect's and Construction Manager's duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulation: The term "Regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Furnish: The term "furnish" is used to mean "supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations."
- G. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, ready for operation, and similar operations."
- H. Provide: The term "provide" means "to furnish and install, complete and ready for the intended use."
- I. Installer: An "Installer" is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
  - 1. The term "experienced," when used with the term "Installer," means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
  - 2. Trades: Use of titles such as "carpentry" is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

## SECTION 01 42 19 – REFERENCE STANDARDS AND DEFINITIONS

3. Assignment of Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in the operations to be performed. The specialists must be engaged for those activities, and assignments are requirements over which the Contractor has no choice or option. Nevertheless, the ultimate responsibility for fulfilling Contract requirements remains with the Contractor.
  - a. This requirement shall not be interpreted to conflict with enforcement of building codes and similar regulations governing the Work. It is also not intended to interfere with local trade union jurisdictional settlements and similar conventions.
- J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. Testing Laboratories: A "testing laboratory" is an independent entity engaged to perform specific inspections or tests, either at the Project Site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

### 1.2 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's 50-Division format and MASTERFORMAT numbering system.
- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
  1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.
  2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mode are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.

### 1.3 INDUSTRY STANDARDS

- A. Applicability of Standards: Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with the standard in effect as of the date of the Contract Documents.

## **SECTION 01 42 19 – REFERENCE STANDARDS AND DEFINITIONS**

- C. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
  - 1. Where copies of standards are needed for performance of a required construction activity, the Contractor shall obtain copies directly from the publication source.
- D. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

### **1.4 SUBMISSIONS**

- A. For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence and records established in conjunction with compliance with standards and regulations bearing upon performance of the work.

**- END OF SECTION 01 42 19 -**

## **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 Specification Sections, apply to this Section.

#### **1.2 SECTION INCLUDES**

- A. Temporary facilities and controls.

#### **1.3 INFORMATIONAL SUBMITTALS**

- A. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
  - 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- B. 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.
  - 6. Use of HEPA machines.

#### **1.4 TEMPORARY FACILITIES AND CONTROLS**

- A. The Contractor shall furnish and place temporary fire extinguishers, #20 dry chemical type, throughout the construction site in areas where cutting, burning, grinding, welding or soldering are performed. Hot Work and Red Tag permits must also be obtained by Public Safety via the Construction Manager prior to starting any work and all their and FM Globals conditions must be met.

## **SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS**

- B. In the instance that the permanent HVAC system is operable and activated during construction at the request of the Construction Manager, the Contractor shall, at no cost to the Owner, furnish and install construction filters on all return ducts and in all air handling units until Substantial Completion. Contractor shall replace temporary filters with permanent final filters prior to Owner acceptance of the air handling equipment. Contractor to change filters on existing and/or new AHU's every (six) 6 months at minimum, if it needs to be changed prior due to construction activities then the contractor shall change them as frequently as required at no cost to the owner.
- C. The buildings HVAC systems shall be capped and sealed in the areas of renovation such that the adjacent/occupied areas of the building are not without heating, ventilation, or air conditioning. Temporary connections may be required at no additional cost.
- D. All NJCU occupied areas of the building are required to have cooling and heating during occupied hours. Coordinate with NJCU and provide any temporary heating or cooling required.

### **PART 2 - PRODUCTS**

#### **2.1 MATERIALS**

- A. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.
- B. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches and maintain as required throughout the entire project.
- C. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

#### **2.2 TEMPORARY FACILITIES**

- A. See general and supplemental general conditions, contract documents

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work. Location to be approved and/or issued by Owner.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Provide temporary heating and cooling required by construction activities where areas of occupied buildings will not have heating or cooling due to construction activities.
- B. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  - 1. Prior to commencing work, isolate the HVAC system in area where work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within work area using HEPA-equipped air-filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
    - c. If the supply ductwork is required to continue to serve an adjacent occupied space, coordinate a method for providing temporary supply air to the adjacent occupied space.
  - 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.
- C. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
- D. Electric Power Service: Connect to Owner's existing electric power service. Provide temporary diesel generator for electric service as required on Contract Documents. All branch circuits serving occupied areas of the building shall be operational each day when the building is occupied.
- E. Fire System: Existing system is to remain operation until new system is approved by DCA. Temporary connections may be required while working on the system and other utilities that could interrupt this. If the system is down for any period of time it will be the contractor's responsibility to provide fire watch as required by FM Global's procedures and NJCU until the system is back in operation.
- F. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
  - 3. All way finding signage shall be furnished and installed by the contractor prior to areas being worked on and modified throughout as required and requested by the Owner.

## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

- G. Parking: No parking is allowed on the main campus. All parking is to be in Lot 3 on Westside or on the streets at your expense and risk. All deliveries are to be made and vehicles immediately moved off site once complete.
- H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- I. Existing Elevator Use: Use of Owner's existing elevators will be limited, provided elevators are cleaned and maintained in a condition acceptable to Owner. One (1) elevator at all times shall be used strictly for the occupants of the building and not to be used by the contractors.
  - 1. Do not load elevators beyond their rated weight capacity.
  - 2. All major deliveries will not be allowed in the elevators during high occupancy use and if over weight limits.
  - 3. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
  - 4. Occupants of the building take priority to use the elevators. Contractors are second priority and may be told they cannot use the elevators at any given time whether or not they are working or not.
  - 5. Elevators need to be operational by 8 a.m. each day the building is occupied. Contractor shall notify NJCU immediately upon failure of the elevator and it maybe the contractors responsibility to pay for any repairs due to your activates.
- J. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
  - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.
  - 2. No storage shall be left in the stairs.

### 3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
  - 1. Comply with work restrictions specified in the contract documents.
- C. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.



## SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

- D. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- E. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction and requirements indicated on Drawings and contract documents.
  - 1. Construct covered walkways using scaffold or shoring framing.
  - 2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage. If permanent walkways are not in place then asphalt walkways will be required as requested by the Owner.
  - 3. Paint and maintain appearance of walkway for duration of the Work.
  - 4. Walkways will have to be relocated throughout the construction progress to complete different areas of work. During the relocations if there are occupants in the building they must always have a protective area to enter/exit. Relocations may have to be done on off hours when the building is closed and no occupants in there. The building is normally occupied from 8:00 am to 10:00 PM Monday through Saturday.
- F. Temporary Partitions: Unless otherwise noted, provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
  - 1. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
  - 2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  - 3. At exterior locations provide exterior grade partitions as required.
  - 4. Insulate partitions to control noise transmission to occupied areas.
  - 5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  - 6. Protect all owners equipment including but not limited to: air-handling equipment, AV, Telecom, occupants equipment remaining in the building, etc..
  - 7. Provide walk-off mats at each entrance through temporary partition.

### 3.4 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.
- 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.

## **SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS**

- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.  
At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Supplemental General Conditions and/or in the contract documents.

**- END OF SECTION 01 50 00 -**

## SECTION 01 70 00 – CLOSEOUT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
1. Systems Demonstration and Training
  2. Operation and Maintenance Manuals.
  3. As-Built Drawings.
  4. Attic Stock.
  5. Valve Charts and One-Line Diagrams.
  6. Guarantees and Warranties.
  7. Substantial Completion.
  8. Final Completion.
  9. List of Incomplete Items (Punch List).

#### 1.2 SYSTEMS DEMONSTRATION AND TRAINING

- A. Demonstrate operation and maintenance of all equipment and systems to the University's personnel two (2) weeks prior to the date of substantial completion and one (1) month after Substantial Completion. Allow for two (2) training and demonstration sessions at each time before/after Substantial Completion. There shall be no minimum time established for each training and demonstration session.
- B. Demonstrate start-up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each piece of equipment and system during the training and demonstration session.
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.

## SECTION 01 70 00 – CLOSEOUT REQUIREMENTS

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 but not limited to, 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.
4. Operations: Include the following but not limited to, 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.
  - l. Required sequences for electric or electronic systems.
  - m. Special operating instructions and procedures.
5. Adjustments: Include the following but not limited to:
  - a. Alignments.
  - b. Checking adjustments.
  - c. Noise and vibration adjustments.
  - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following but not limited to:
  - a. Diagnostic instructions.
  - b. Test and inspection procedures.

## SECTION 01 70 00 – CLOSEOUT REQUIREMENTS

7. Maintenance: Include the following but not limited to:
  - 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.
  - h. Instructions on methods and material agents known to be detrimental and to be avoided.
  
8. Repairs: Include the following but not limited to:
  - 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.

- C. In addition to above, for equipment and systems requiring seasonal operation, provide an additional two (2) training and demonstration sessions for each season change.
- D. All demonstration and training is to be provided by a manufacturer's representative of the equipment and system whether or not it is stated in the technical specifications. Onsite superintendent's and/or foremen are not acceptable for this requirement.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with the University's personnel in detail to explain all aspects of operation and maintenance.
- F. The demonstration and maintenance instruction is to be digitally recorded by a professional, paid by the Contractor, with two (2) flash drive copies being provided to the Owner.
- G. Notify CM seven (7) calendar days prior to demonstration of each item for Owner's availability and issue a detailed agenda for each training items which should include all of the above items at minimum.
- H. Each trade as requested by the CM, A/E, and/or, Owner shall walk and show the Owner's staff all the new equipment, operation, etc. installed as required in addition to the above.

### 1.3 OPERATION AND MAINTENANCE MANUALS

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products. Final payment will not be processed until submitted and approved. A total of two (2) copies and an electronic version on flash drive shall be submitted.
- B. Prepare data in the form of an instructional manual.

## SECTION 01 70 00 – CLOSEOUT REQUIREMENTS

- C. Binders are to be commercial quality, 8-1/2 x 11 inch three ring binders with durable plastic covers. When multiple binders are used, correlate data into related consistent groupings.
1. Identify each binder with typed or printed title (on the spine and cover) “Operation and Maintenance Instructions”, identify the project, and identify subject matter of contents.
  2. Provide tabbed dividers for each separate product and system, with typed description of product and major component parts of equipment.
  3. Arrange content by systems under section numbers and sequence table of contents of the project manuals.
  4. Manuals are to include the following information:
    - a) Subcontractor and suppliers names, addresses, and phone numbers
    - b) Significant design data
    - c) List of equipment
    - d) Parts list for each component
    - e) Operating instructions
    - f) Maintenance instructions for equipment and systems
    - g) Maintenance instructions for special finishes, included recommended cleaning methods and materials, and special precautions identifying detrimental agents
    - h) Shop drawings and product data
    - i) Warranties
    - j) Emergency Manuals:
      - 1) Organize manual into a separate section for each of the following:
        - i. Type of emergency.
        - ii. Emergency instructions.
        - iii. Emergency procedures.
      - 2) 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 for Fire, Flood, Gas leak, Water leak, Power failure, Water outage, System, subsystem, or equipment failure and Chemical release or spill
      - 3) Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
      - 4) Emergency Procedures: Include instructions on stopping, shutdown instructions for each type of emergency, operating instructions for conditions outside normal operating limits, and required sequences for electric or electronic systems.

### 1.4 AS-BUILT DRAWINGS

- A. In addition to what is in the general conditions the Contractor shall maintain a clean, undamaged set of Contract Drawings, Specifications, and Shop Drawings. Mark the set to show the actual installation where the installation varies from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

## **SECTION 01 70 00 – CLOSEOUT REQUIREMENTS**

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
  2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
  3. Note related Change Order numbers where applicable.
  4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
  5. All utilities outside the building shall be located by a survey performed by a licensed surveyor who shall certify as to its accuracy.
- B. The Contractor shall submit two (2) color copies of these documents to the Construction Manager, whether altered or not, with a certification as to the accuracy of the information thereon at the time of contract completion before final payment is made to the Contractor. A digital .pdf and CADD plans shall also be generated by the contractor and submitted as part of the closeout.
- C. The as-builts shall be updated daily by all trades and will need to be reviewed and approved by the Construction Manager or progress payments will not be approved.

### **1.5 ATTIC STOCK**

- A. The Contractor shall provide and deliver all attic stock specified in the Contract Documents to a location designated by the University. The Contractor shall provide the following attic stock at a minimum if not specified elsewhere in the Contract Documents:
1. Five (5) unopened boxes of each floor tile and resilient tile used
  2. Five (5) unopened boxes of each floor base used
  3. Five (5) unopened boxes of each carpet tile used
  4. Five (5) unopened boxes of each type of ceiling tiles used
  5. Sprinkler box with additional heads and tools
- B. Should there be a conflict between the above and elsewhere in the Contract Documents; the largest quantity shall be supplied by the Contractor.

## SECTION 01 70 00 – CLOSEOUT REQUIREMENTS

### 1.6 VALVE CHARTS AND ONE-LINE DIAGRAMS

- A. The Contractor shall prepare a complete set of typewritten control valve and circuit location diagrams, charts, diagrams and lists under frame glass in appropriate designated equipment rooms. The Contractor shall also furnish one-line diagrams, as well as such color coding of piping and wiring and identifying charges as specified or required. This information to be framed under glass and installed where directed.

### 1.7 GUARANTEES AND WARRANTIES

- A. All guarantees and warranties required by the Specifications shall be in writing in requisite legal form and delivered to the Construction Manager. All Subcontractor's guarantees and warranties shall be underwritten by the Contractor, who shall obtain and deliver same to the Construction Manager before the Work shall be deemed finished and accepted.

### 1.8 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting on-site visit for determining date of Substantial Completion, complete the following for each phase of the project:
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise the Construction Manager, who will advise the Owner, of pending insurance changeover requirements.
  - 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
  - 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
  - 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs and photographic negatives, damage or settlement surveys, property surveys, and similar final record information.
  - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 7. Make final changeover of permanent locks and deliver keys to the Owner in the Construction Manager's presence. Advise the Owner's personnel with the Construction Manager present of changeover in security provisions.
  - 8. Complete startup testing of systems.
  - 9. Submit test/adjust/balance records.
  - 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
  - 11. Advise the Construction Manager to advise the Owner of changeover in heat and other utilities.
  - 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  - 13. Complete final cleaning requirements, including touchup painting.
  - 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.



## SECTION 01 70 00 – CLOSEOUT REQUIREMENTS

B. Inspection: Submit a written request for on-site review for Substantial Completion as follows:

1. On receipt of request, Architect and Construction Manager will either proceed with their site visit or notify Contractor of unfulfilled requirements. After inspection the Architect will prepare the Certificate of Substantial Completion or will notify Contractor of items, either on Contractor's list or additional items identified by Architect that must be completed or corrected before the certificate will be issued.
2. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
3. Additional Re-inspections: If more than two (2) site visits are required to be made by the Architect and Construction Manager, the Owner shall deduct \$500.00 for half a day or \$1,000.00 for a full day from the Contract Value for each re-inspection required.
4. Results of completed inspection will form the basis of requirements for Final Completion.

### 1.9 FINAL COMPLETION/READY FOR CLOSEOUT

A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:

1. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
2. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
3. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
4. Consent of Surety for Final Payment.

B. Inspection: Submit a written request for final inspection/closeout on the attached form provided Form 00 95 00 – Ready for Closeout. On receipt of request, Architect and Construction Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Additional Re-inspections: If more than two (2) re-inspections are required to be made by the Architect and Construction Manager, the Owner shall deduct \$500.00 for half a day or \$1,000.00 for a full day from the Contract Value for each re-inspection required.

## **SECTION 01 70 00 – CLOSEOUT REQUIREMENTS**

### **1.10 LIST OF INCOMPLETE ITEMS (PUNCH LIST)**

- A. Preparation: Submit with Request for Substantial Completion Inspection, three (3) copies of punchlist. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
  2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Architect and Construction Manager.
    - d. Name of Contractor.
    - e. Page number.

**- END OF SECTION 01 70 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. Crane logistics plan.
3. Field engineering and surveying.
4. Installation of the Work.
5. Cutting and patching.
6. Coordination of Owner-installed products.
7. Progress cleaning.
8. Starting and adjusting.
9. Protection of installed construction.
10. Correction of the Work.

- B. Related Requirements:

1. Section 01 11 00 "Summary" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 70 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### 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 professional engineer.

## SECTION 01 73 00 - EXECUTION

- B. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

### 1.5 QUALITY ASSURANCE

- A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
  - 1. Structural Elements: 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.
  - 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.
  - 4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.
- C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
  - 1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

## SECTION 01 73 00 - EXECUTION

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
  2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
- B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
  2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
  3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
1. Description of the Work.
  2. List of detrimental conditions, including substrates.
  3. List of unacceptable installation tolerances.
  4. Recommended corrections.
- D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

#### 3.2 PREPARATION

- A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

## SECTION 01 73 00 - EXECUTION

- 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 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 Engineer and Construction Manager promptly.
- B. **Site Improvements:** Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.
- C. **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 Engineer and Construction Manager.

### 3.4 CRANE LOGISTICS PLAN

- A. Prior to any rigging utilizing a crane on campus the Contractor must submit a crane logistics plane showing at least the following:
  - 1. Location of the crane.
  - 2. Travel path of the equipment being rigged.
  - 3. Identification of any buildings the equipment/material being rigged will be traveling over.
  - 4. Equipment information being rigged.
  - 5. Contractor's recommended date and time for rigging, this Logistics plan must be issued to the Construction Manager one (1) week prior to any lifts for Owner review and approvals.
  - 6. Traffic plan and permit from Jersey City Police (to be coordinated and paid for by this contractor) if applicable.
  - 7. Areas that need to be vacated.

## SECTION 01 73 00 - EXECUTION

### 3.5 FIELD ENGINEERING

- A. 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 Engineer or Construction Manager. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer and Construction Manager before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

### 3.6 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.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels, vibrations, and/or any odors.
- G. 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.
- H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

## SECTION 01 73 00 - EXECUTION

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by 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.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.7 CUTTING AND PATCHING

- A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.
- C. Temporary Support: Provide temporary support of work to be cut.
- D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- E. 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" and Section 00 31 13 "Milestone Schedule". Work shall be performed when the building is not occupied and coordinated with the Owner.
- F. 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 prevent interruption to occupied areas. Work shall be performed when the building is not occupied and coordinated with the Owner.
- G. 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.



## SECTION 01 73 00 - EXECUTION

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.
  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. All holes need to be patched per proper ratings.
  7. No gas powered equipment to be used in occupied buildings, near building intakes, and operable windows.
- H. 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. Patch any existing openings to match existing, adjacent construction. Provide materials and comply with installation requirements specified in other Sections, where applicable.
1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
  2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    - a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
  4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
  5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

## SECTION 01 73 00 - EXECUTION

- I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

### 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 days during normal weather or three days if the temperature is expected to rise above 80 deg F.
  3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
    - a. Use containers intended for holding waste materials of type to be stored.
  4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.
  5. Walk off mats will be required from construction to occupied and/or non-construction areas.
  6. Floors to be vacuum and/or mopped clean if required by Owner.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
  2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

## SECTION 01 73 00 - EXECUTION

- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.9 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."
- E. Owner shall be present for all start ups, seven (7) day notice is to be issued prior to any start-ups.

### 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.

END OF SECTION 01 73 00

## **SECTION 01 74 00 – 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 Division 01 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

- A. This 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.

#### **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 SUBMITTALS**

- A. Waste Management Plan: Submit plan within thirty (30) days of date established for the Notice to Proceed.

## **SECTION 01 74 00 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

- B. 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.
- C. 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.

### **1.5 QUALITY ASSURANCE**

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

### **1.6 WASTE MANAGEMENT PLAN**

- A. General: Develop plan consisting of waste identification. Include separate sections in plan for 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 and construction waste generated by the Work.

## **PART 2 - PRODUCTS (Not Used)**

## **PART 3 - EXECUTION**

### **3.1 PLAN IMPLEMENTATION**

- A. General: Implement waste management plan as approved by Owner. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.
- B. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, fire lanes and other adjacent occupied and used facilities.
  - 1. Comply with Division 01 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

## **SECTION 01 74 00 – CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL**

### 3.2 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: Transport waste materials off Owner's property and legally dispose of them.

END OF SECTION 01 74 00

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. ASHRAE Guideline 0-2005 “The Commissioning Process”
- B. U.S. Green Building Council LEED v2009 “Reference Guide for Green Building Design & Construction”

#### 1.2 DESCRIPTION

- A. Summary. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner’s operational needs. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. The commissioning process does not take away from, or reduce the responsibility of, the General Contractor and installing subcontractors to provide a finished and fully-functioning product.
- B. Purpose. Commissioning during the construction phase is intended to achieve the following specific objective according to the Contract Documents:
  - 1. Verify that applicable equipment and systems are installed according to the manufacturer’s recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
  - 2. Verify and document proper performance of equipment and systems.
  - 3. Verify that O&M documentation left on site is complete.
  - 4. Verify that the Owner’s operating personnel are adequately trained.

#### 1.3 COORDINATION

- A. Commissioning Team. The members of the commissioning team consist of the designated representative of the Owner, Commissioning Authority (CA), the Architect and Design Engineers (particularly the mechanical engineer), General Contractor (GC), the Mechanical Contractor (MC), the TAB representative, the Electrical Contractor (EC), the Controls Contractor (CC), the Plumbing Contractor (PC) and the Fire Protection Contractor (FPC). If known, the Owner’s building operator/engineer is also a member of the commissioning team.
- B. Management. The CA has been hired by the Owner. The CA directs and coordinates the commissioning activities and is part of the design team. All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.
- C. Scheduling. The CA will work with the Cx team according to established protocols to schedule the commissioning activities. The CA will provide sufficient notice to the Cx team for scheduling commissioning activities. The Contractor will integrate all commissioning activities into the CPM schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process.

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

### 1.4 COMMISSIONING PROCESS

- A. Commissioning Process. The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
1. Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
  2. Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
  3. Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.
  4. The CA works with the GC and the Subcontractors/equipment suppliers in developing startup plans and startup documentation formats.
  5. In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with pre-functional checklists being completed before functional testing.
  6. The Subs, under their own direction, execute and document the pre-functional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This will include the CA witnessing start-up of selected equipment.
  7. The CA develops specific equipment and system functional performance test procedures. The Subcontractors review the procedures.
  8. The procedures are executed by the Subcontractors, under the direction of, and documented by the CA.
  9. Items of non-compliance in material, installation or setup are corrected at the Subcontractors' expense and the system retested.
  10. The CA reviews the O&M documentation for completeness.
  11. Commissioning is completed before Substantial Completion.
  12. The CA reviews, pre-approves and witnesses the training provided by the Subcontractors and verifies that it was completed.
  13. Deferred testing is conducted, as specified or required.

### 1.5 RELATED WORK

- A. Specific Commissioning (Cx) requirements are given in the following sections of these specifications. All of the following sections apply to the Work of this section:
1. Division 21 Fire Protection Systems Cx – Describes the Cx responsibilities of the Fire Protections Contractor and the pre-functional testing and startup responsibilities.
  2. Division 22 Plumbing Cx - Describes the Cx responsibilities of the Plumbing Contractor and the pre-functional testing and startup responsibilities.
  3. Division 23 HVAC Cx - Describes the Cx responsibilities of the Mechanical, Controls and TAB Contractors and the pre-functional testing and startup responsibilities of each.
  4. Divisions 26-28 Electrical Cx - Describes the Cx responsibilities of the Electrical Contractor and the pre-functional testing and startup responsibilities.



## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

### 1.6 RESPONSIBILITIES

A. The responsibilities of various parties in the commissioning process are provided in this section. It is noted that the services for the Architect, MEP Designers/Engineers, and Commissioning Authority are not provided for in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

B. All Parties

1. Follow the Commissioning (Cx) Plan.
2. Attend commissioning scoping meeting and additional Cx meetings, as necessary.

C. Mechanical, Electrical and Plumbing Designers/Engineers

*Design, Construction and Acceptance Phase*

1. Perform normal submittal review, construction observation, as-built drawing preparation, etc., as contracted. One site observation should be completed just prior to system startup.
2. Provide any design narrative and sequences documentation requested by the CA. The designers shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
3. Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents.
4. Prepare and submit the final as-built design intent and operating parameters documentation for inclusion in the O&M manuals. Review and approve the O&M manuals.
5. Edit and update one-line diagrams developed as part of the design narrative documentation and those provided by the vendor as shop drawings for the various Mechanical, Electrical, and Plumbing systems.

D. Commissioning Authority (CA)

The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the A/E. The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems.

*Design, Construction and Acceptance Phase*

1. Coordinate the commissioning work and, with the A/E, ensure that commissioning activities are being scheduled into the master schedule.
2. Plan and conduct a commissioning scoping meeting, start-up and deficiency meetings as required.

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

3. Request and review additional information required to perform commissioning tasks, including O&M materials, control sequences, contractor start-up and checkout procedures.
4. Before startup, gather and review the current control sequences and interlocks and write detailed testing procedures.
5. Review and approve normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs.
6. Write and distribute pre-functional tests and checklists.
7. Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress.
8. Witness all or part of the HVAC/Plumbing piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Document this testing and include the documentation in O&M manuals. Notify the A/E of any deficiencies in results or procedures.
9. Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot-checking.
10. Approve systems startup by reviewing start-up reports and by selected site observation.
11. Review TAB execution plan.
12. Analyze any functional performance trend logs and monitoring data to verify performance.
13. Compile and maintain a commissioning record and building systems book(s).
14. Review and approve the preparation of the O&M manuals.
15. Provide a final commissioning report.

### E. Architect/Engineering Firm

#### *Design, Construction and Acceptance Phase*

1. Facilitate the coordination of the commissioning work by the CA, and, with the CA, ensure that commissioning activities are being scheduled into the master schedule.
2. Review and approve the final *Construction Commissioning Plan*.
3. Attend a commissioning scoping meeting and other commissioning team meetings as needed.
4. When necessary, observe and witness pre-functional checklists, startup and functional testing of selected equipment
5. Review commissioning progress and deficiency reports.

### F. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subcontractors.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor. Through the contractors they supply products to, analyze specified products and verify that the designer has specified the newest most updated equipment reasonable for this project's scope.
4. Provide information requested by CA regarding equipment sequence of operation and testing procedures.
5. Review test procedures for equipment installed by authorized factory representatives.

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

### G. Controls & TAB Contractors

1. Controls & TAB Contractors will be responsible to carry out the commissioning requirements specified in Division 23.

### 1.7 SYSTEMS TO BE COMMISSIONED

- A. This project will require integrated total building commissioning to include all of the following systems:

Plumbing- Inclusive of all systems, including Domestic Hot Water
Fire Protection - Sprinkler and Fire Alarm
HVAC - Inclusive of all systems including Controls
Electrical - Inclusive of all systems, including Daylighting/Lighting Controls systems
Telecommunications - Wiring and terminations

### PART 2 - PRODUCTS – (NOT APPLICABLE)

### PART 3 - EXECUTION

#### 3.1 REPORTING

- A. The CA will provide regular field reports to the Owner as construction and commissioning progresses.
- B. The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos and progress reports.
- C. A final summary report by the CA will be provided to the Owner. All acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc., will be compiled in appendices and provided with the summary report. Pre-functional checklists, functional tests and monitoring reports will not be part of the final report, but will be stored in the Commissioning Record in the O&M manuals.

#### 3.2 START-UP, PREFUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

- A. The following procedures apply to all equipment to be commissioned, according to Section 1.6, "Systems to be Commissioned".
  1. Pre-functional checklist.
  2. Start-up: The start-up plan shall consist of:
    - a. The CA's pre-functional checklist.

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

- b. The manufacturer's standard start-up procedure
- c. The manufacturer's standard field checkout sheets.

### B. Execution of Pre-functional Checklists and Startup.

- 1. The CA shall observe, at minimum, the procedures for each piece of primary equipment, unless there are multiple units. In no case will the number of units witnessed be less than 25% of the total number of identical or very similar units.
- 2. For lower-level components of equipment, (e.g., unit heaters, sensors, controllers), the CA shall observe a sampling of the pre-functional and start-up procedures. The sampling procedures are identified in the commissioning plan.
- 3. The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and pre-functional tests and checklists for 100% of all commissioned equipment.

### C. Deficiencies, Non-Conformance and Approval in Checklists and Startup.

- 1. The Subs shall clearly list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.
- 2. The CA reviews the report and submits either a non-compliance report or an approval form to the A/E. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and a Statement of Correction on the original non-compliance report. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system.

## 3.3 FUNCTIONAL PERFORMANCE TESTING

- A. This sub-section applies to all commissioning functional testing for all divisions.
- B. The general list of equipment to be commissioned is found in Section 1.6 of this specification
- C. Objectives and Scope. The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing facilitates bringing the systems from a state of substantial completion to full dynamic operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required.
- D. Development of Test Procedures. Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. The CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. Each Sub or vendor responsible to execute a test shall

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

provide assistance to the CA in developing the procedures review. Prior to execution, the CA shall provide a copy of the test procedures to the Sub(s) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.

- E. Coordination and Scheduling. The Subs shall provide sufficient notice to the CA regarding their completion schedule for the pre-functional checklists and startup of all equipment and systems. The CA will schedule functional tests through the A/E and affected Subs. The CA shall direct, witness and document the functional testing of selected equipment and systems. The Subs shall execute the tests.
- F. In general, functional testing is conducted after pre-functional testing and startup has been satisfactorily completed. The control system is sufficiently tested and approved by the CA before it is used for TAB or to verify performance of other components or systems. The air balancing and water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interface or coordinated responses between systems is checked.

### 3.4 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

- A. Documentation. The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the CA for review and approval and to the Subs for review.
- B. Non-Conformance.
  - 1. The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the Owner.
  - 2. Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA.
  - 3. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the Owner.
- C. Approval. The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA.

### 3.5 OPERATION AND MAINTENANCE MANUALS

- A. Commissioning Record in O&M Manuals.

## SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS

1. The CA is responsible to compile, organize and index the following commissioning data by equipment into labeled, indexed and tabbed, three-ring binders and deliver it to the Owner. Three copies of the manuals will be provided.
2. Final Report Details. The final commissioning report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report should contain the disposition of the commissioning authority regarding the adequacy of the equipment, documentation and training meeting the contract documents in the following areas: 1) Equipment meeting the equipment specifications, 2) Equipment installation, 3) Functional performance and efficiency, 4) Equipment documentation and design intent, and 5) Operator training. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall also be listed. Each non-compliance issue shall be referenced to the specific functional test, inspection, trend log, etc. where the deficiency is documented.

### 3.6 TRAINING OF OWNER PERSONNEL

- A. The GC shall be responsible for training coordination and scheduling, and ultimately for ensuring that training is completed.
- B. The CA shall be responsible for approving the content and adequacy and witnessing of the training of owner personnel for commissioned equipment.

### 3.7 DEFERRED TESTING

- A. Unforeseen Deferred Tests. If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the Owner. These tests will be conducted in the same manner as the seasonal tests as soon as possible.
- B. Seasonal Testing. During the warranty period, seasonal testing shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builds due to the testing will be made.

### 3.8 ENHANCED COMMISSIONING

- A. The CA will review GC submittals applicable to systems being commissioned (see Part 1.6 of this section) for compliance with the Owner's project requirements and basis of design.
- B. The CA will develop a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.

## **SECTION 01 91 13 GENERAL COMMISSIONING REQUIREMENTS**

- C. The CA will verify that the requirements for training operating personnel and building occupants have been completed.
- D. The entire Commissioning Team (see Part 1.2 of this section) will be involved in reviewing the operation of the building with operations and maintenance (O&M) staff and occupants within 10 months after substantial completion. A plan for resolving any outstanding commissioning-related issue will be developed and implemented by this Commissioning Team.

END OF SECTION 01 91 13



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# **DIVISIONS 2-28**

**NEW JERSEY CITY UNIVERSITY  
2039 KENNEDY BOULEVARD  
JERSEY CITY, NEW JERSEY 07305-1597**

## **NURSING EDUCATION CENTER**

**PROJECT No. 4131  
BID No. 17-024**

### **Technical Specifications**

**December 4, 2017**



## SECTION - 028213 ABATEMENT

### **PART 1.0 - GENERAL REQUIREMENTS**

- 1.1 The specification contained herein forms but a part of all sections and of the entire project specification. The Contractor shall become thoroughly familiar with all requirements and is bound by all terms and conditions contained in this specification.
- 1.2 This section specifies the requirements for removal of asbestos-containing and/or asbestos-contaminated materials from **Rossey Hall** on the campus of New Jersey City University in Jersey City. Asbestos removal is an environmental decontamination project, not a normal demolition project. Failure to execute this work in an effective manner can greatly increase the health hazard to building occupants, citizens of the community and the Contractor's staff. It is generally accepted that an improper removal job can create a worse hazard than taking no action at all.
- 1.3 Any plans, reports, written instructions, or verbal instructions are for reference purposes only. THE CONTRACTOR SHALL VERIFY FOR THEMSELVES THE TOTAL EXTENT OF THE PROJECT, INCLUDING FOOTAGES OF MATERIAL AND REMOVAL AREAS. It is the Contractor's responsibility to review the written specification in conjunction with any Contract Drawings. No subsequent extras, change orders, or compensation shall be provided due to failure of the Contractor to evaluate the total extent of the project or for errors or omissions in this specification.
- 1.4 Should the Contractor find any discrepancies in, or omissions from, any of the documents, or be in any doubt as to their meaning, he shall notify the Project Manager who shall issue all necessary clarifications by means of written correspondence or revised drawings. The Project Manager shall not be responsible for any oral instructions.
- 1.5 It is a procedural requirement that the Contractor maintain and require prime subcontractors to maintain complete current information on jurisdictional matters, regulatory actions and pending actions as applicable to the work, discuss new developments at appropriate project meetings at the earliest feasible dates, and record information of relevance along with the action agreed upon. The manner in which Contract Documents have been organized and subdivided is not intended to be an indication of jurisdictional or trade union agreements. It is the Contractor's responsibility to assign and/or subcontract the work and employ tradesmen and laborers in a manner which shall not unduly risk jurisdictional disputes of a kind which could result in conflicts, delays, claims, or losses in the performance of work.
- 1.6 The work of this contract can be summarized by references to the contract, including general conditions, supplementary conditions, specification sections, addenda and modifications to the contract documents issued subsequent to the initial printing of this project manual and including, but not limited to, printed material referenced by any of these. It is recognized that the work of the contract is also unavoidably affected or influenced by governing regulations, natural phenomena including weather conditions and other forces outside the contract documents.
- 1.7 The Building Owner and/or their representatives and consultants bear no responsibility in enforcing the provisions of any patents or licensing agreements regarding any methods, processes or products used in the course of this asbestos abatement project. It is the responsibility of the Contractor to ensure that they have all proper agreements in place regarding any patents or licensing agreements for the use of any methods, processes or products during this project.
- 1.8 The work practices contained in this specification shall serve as a guide in performing the work. No passages contained herein shall be construed as waiving or modifying any requirements of NJAC 5:23-8 (New Jersey Asbestos Hazard Abatement Subcode). The Contractor shall be expected to be familiar with all aspects of NJAC 5:23-8 and all work on this project shall be performed in accordance with the provisions of NJAC 5:23-8, where applicable.

### **PART 2.0 - SCOPE OF WORK**

#### **2.1 Rossey Hall - 4th Floor / 5th Floor / 6th Floor**

All work procedures, including final breakdown and cleanup, conducted at the Rossey Hall facility shall be completed within the time frames prescribed by New Jersey City University or their representatives. Where required, New Jersey City University or their representatives shall determine the sequence and scheduling for the work areas to coincide with the construction schedule. The work may be scheduled for after normal hours and/or on weekends.

The work shall be done in three phases. Each floor where work is to be done shall constitute one phase with one mobilization.

- a. Prior to commencement of any work, the Contractor shall make a complete inspection all work areas and issue in writing a complete report of the existence of any damages to the OWNER or their representatives upon the date of the contract origin. The Contractor shall be held liable for rectifying all damages not contained in the initial report.
- b. Prior to any work, the Contractor shall ensure that the building Owner has disabled the HVAC systems or any other systems bringing air into or out of the work area(s) by lockable switch, or other positive means that shall prevent accidental restarting of equipment. All accessible air handling or ventilation equipment and fixtures shall be sealed with two (2) layers of six (6) mil polyethylene.
- c. As per any applicable contract drawings and as part of the abatement work, the Contractor shall remove and dispose of as asbestos-containing materials the following:

**ROSSEY HALL**

Material	Location(s) (Amount)
<b>PHASE 1 - 5TH FLOOR (1 Week)</b>	
Floor Tile and Mastic	Office 503 / Storage 505 / Office 506 / Storage 507 / Office 508 / 503-508 Hallway Area / Room 509 / Room 513 / Storage 552 / Main Hallway (Approx. 3,500 square feet)
<b>PHASE 2 - 4TH FLOOR (1 Week)</b>	
Floor Tile and Mastic	Room 404 / Office 405H / Conference Room 405J / Room 412 / Room 414 / Main Hallway (Approx. 5,800 square feet)
<b>PHASE 3 - 6TH FLOOR (2 Weeks)</b>	
Floor Tile and Mastic	Room 601 / Room 602 / Room 603 / Room 604 / Storage 604A / Room 605 / Room 606 / Office Area 608 / Office 609 / Conference Room 610 / Copy Room 611 / Office 612 / Office 613 / Office 614 / Office 615 / 612-615 Hallway Area / Room 616-617 / Dark Room 618 / Room 619 / Storage 620 / 618-620 Hallway Area / Room 623 / Room 624 / Storage 627 / Storage 628 / Main Hallway (Approx. 8,700 square feet)
Transite Fume Hoods with Cloth Vibration Collars	Room 605 / Room 606 / Room 623 (Approx. 180 square feet / 3 collars)
Lab Slate Counter/ Table Tops	Room 601 / Room 602 / Room 603 / Room 604 / Room 605 / Room 606 / Room 616-617 / Room 620 / Room 623 (Approx. 800 square feet)

- d. The abatement of the floor tile and mastic materials shall be performed using non-friable methods which shall not contaminate the building environment with airborne asbestos fibers, as follows:
  1. All HVAC equipment, windows and other openings found inside the work area shall be sealed with a silicone caulk, fire-rated expanding foam or two (2) layers of six mil polyethylene.
  2. Air filtration units shall be in operation at all times inside the work areas and exhausted outside the building. One air change shall be provided every fifteen (15) minutes.
  3. Workers shall wear proper respiratory protection and disposable clothing at all times.
  4. The Contractor shall install airtight critical barriers of two (2) layers of six (6) mil polyethylene on all windows, doorways and other openings found in the regulated area.

5. The tiles shall be removed by applying heat to the surface using an approved heating device. Each individual tile shall be pried from the surface using scrapers and placed in a disposal bag in an intact condition. No hatchets or hammers shall be permitted. In areas where the tiles have been installed on a layer of plywood, the Contractor may remove the wood layer with the tiles attached (without damaging them) and wrap the pieces in two (2) layers of six (6) mil polyethylene for disposal.
6. If the Contractor employs any method for the removal of the flooring materials that, in the opinion of the Building Owner, their representatives or state regulatory inspectors, causes (or could possibly cause) the building environment to be contaminated with airborne asbestos fibers, all work shall stop until the area is prepared under full containment.
7. Electrical power and water for the work areas shall be drawn from the facilities outside of the work areas. All electrical power serving the work area shall be locked out at the panel box and tagged by a certified electrician provided by the Contractor. Alternative sources of electrical power and water must be approved by the owner or their representatives.
8. All waste shall be packaged in two (2) six (6) mil polyethylene bags for removal from the site. All sharp-edged materials shall be packaged in fiber drums or burlap bags in addition to the polyethylene bags.
9. If the floor covering materials are located beneath carpeting, the carpeting shall be peeled back from the wall to allow access to the tiles and mastic. If the tile adheres to the carpeting, the tiles shall be peeled off of the carpeting.
10. All mastic shall be removed from concrete or leveler sub-flooring using low-odor or no-odor solvents.
11. Where mastic is to be removed using solvents, the Contractor shall secure one (1) layer of six (6) mil polyethylene to the walls in the work areas, up to a height of at least three feet (3'). In floor tile mastic removal areas located above another floor or occupied space, the Contractor shall inspect the area below the work area prior to the application of the floor tile mastic remover. The Contractor shall employ any and all measures that are required to prevent the leakage of mastic remover into the area below. If any mastic remover leaks into the area below, it shall be the Contractor's responsibility to immediately clean up the mastic remover and any contaminated items. As the work is being performed, at the end of each shift and at the conclusion of the project, the Contractor shall inspect the areas below each work area and make sure that no mastic remover is found in the area. In floor tile mastic removal areas adjacent to carpeted floors, the Contractor shall protect the carpeting from being damaged by the mastic remover.
12. Any free-standing containment barriers or tunnels shall be constructed of three (3) layers of six (6) mil polyethylene mounted on 2" x 4" studs placed 16" o. c. apart. Furring strips shall be used as needed.
13. In order to properly remove the floor covering materials, the Contractor shall disassemble and/or remove any equipment, appurtenances or fixtures as needed.
14. The Contractor shall remove and dispose of all cove base molding materials found in the floor tile and mastic removal areas.
15. Most of the areas of floor tile and mastic removal will require removal of multiple layers of floor covering materials. The asbestos abatement contractor shall remove all layers of floor covering materials found in each area down to the concrete substrate, as follows:

Room/Location	Layer(s) of Existing Floor Covering Materials To Be Removed
<b>PHASE 1 - 5TH FLOOR</b>	
Office 503 / Storage 505 / Office 506 / Storage 507 / Office 508 / 503-508 Hallway Area	9" x 9" Tile / Mastic
Room 509 / Room 513 / Storage 552 / Main Hallway	12" x 12" Tile / 9" x 9" Tile / Mastic

Room/Location	Layer(s) of Existing Floor Covering Materials To Be Removed
<b>PHASE 2 - 4TH FLOOR</b>	
Room 404 / Room 414 / Main Hallway	12" x 12" Tile / 9" x 9" Tile / Mastic
Office 405H / Conference Room 405J	Carpet / 9" x 9" Tile / Mastic
Room 412	Carpet / 12" x 12" Tile / 9" x 9" Tile / Mastic
<b>PHASE 3 - 6TH FLOOR</b>	
Room 601 / Room 602 / Room 603 / Room 604 / Storage 604A / Room 605 / Room 606 / Room 616-617 / Dark Room 618 / Room 619 / Storage 620 / 618-620 Hallway Area / Room 623 / Main Hallway	12" x 12" Tile / 9" x 9" Tile / Mastic
Office Area 608 / Office 609 / Copy Room 611 / Office 612 / Office 613 / Office 614 / Office 615 / 612-615 Hallway Area / Room 624	9" x 9" Tile / Mastic
Conference Room 610	Carpet / 9" x 9" Tile / Mastic

- e. The abatement of the transite fume hoods shall be performed using non-friable methods which shall not contaminate the building environment with airborne asbestos fibers, as follows:
1. All HVAC equipment, windows and other openings found inside the work area shall be sealed with a silicone caulk, fire-rated expanding foam or two (2) layers of six mil polyethylene.
  2. Air filtration units shall be in operation at all times inside the work areas and exhausted outside the building. One air change shall be provided every fifteen (15) minutes.
  3. Workers shall wear proper respiratory protection and disposable clothing at all times.
  4. The Contractor shall install airtight critical barriers of two (2) layers of six (6) mil polyethylene on all windows, doorways and other openings found in the regulated area.
  5. The fume hood components shall be removed by carefully disassembling any brackets and/or frames holding the units in place. Each hood panel shall be removed from the brackets or frame in an intact condition. The pieces shall be properly packaged for disposal. No cutting of the pieces shall be permitted.
  6. Each fume hood has one cloth vibration collar on the exhaust duct above the hood. The collar shall be removed in an intact condition and disposed of as asbestos-containing waste.
  7. If the Contractor employs any method for the removal of the transite panels that, in the opinion of the Building Owner, their representatives or state regulatory inspectors, causes (or could possibly cause) the building environment to be contaminated with airborne asbestos fibers, all work shall stop until the area is prepared under full containment.
  8. Electrical power and water for the work areas shall be drawn from the facilities outside of the work areas. All electrical power serving the work area shall be locked out at the panel box and tagged by a certified electrician provided by the Contractor. Alternative sources of electrical power and water must be approved by the owner or their representatives.
  9. Any free-standing containment barriers or tunnels shall be constructed of three (3) layers of six (6) mil polyethylene mounted on 2" x 4" studs placed 16" o.c. apart. Furring strips shall be used as needed.
- f. The abatement of the lab slate counter tops and table tops shall be performed using methods which shall not contaminate the building environment with airborne asbestos fibers, as follows:

1. All HVAC equipment, windows and other openings found inside the work area shall be sealed with a silicone caulk, fire-rated expanding foam or two (2) layers of six mil polyethylene.
  2. Air filtration units shall be in operation at all times inside the work areas and exhausted outside the building. One air change shall be provided every fifteen (15) minutes.
  3. Workers shall wear proper respiratory protection and disposable clothing at all times.
  4. The Contractor shall install airtight critical barriers of two (2) layers of six (6) mil polyethylene on all windows, doorways and other openings found in the regulated area.
  5. The slates shall be removed by removing any screws, brackets or other fasteners which are holding the top to the counter or the table. Each individual slate piece shall be carefully removed and packaged properly for disposal. No cutting of the pieces shall be permitted.
  6. If the Contractor employs any method for the removal of the slates that, in the opinion of the Building Owner, their representatives or state regulatory inspectors, causes (or could possibly cause) the building environment to be contaminated with airborne asbestos fibers, all work shall stop until the area is prepared under full containment.
  7. Electrical power and water for the work areas shall be drawn from the facilities outside of the work areas. All electrical power serving the work area shall be locked out at the panel box and tagged by a certified electrician provided by the Contractor. Alternative sources of electrical power and water must be approved by the owner or their representatives.
  8. All waste shall be packaged in two (2) six (6) mil polyethylene bags or securely wrapped in two (2) layers of six mil polyethylene sheeting for removal from the site. All sharp-edged materials shall be packaged in fiber drums or burlap bags in addition to the polyethylene bags or sheeting.
  9. Any free-standing containment barriers or tunnels shall be constructed of three (3) layers of six (6) mil polyethylene mounted on 2" x 4" studs placed 16" o.c. apart. Furring strips shall be used as needed.
- 2.2 The Contractor shall keep all stairs, lobbies and lavatories free from the accumulation of waste material, rubbish or construction waste.
  - 2.3 Except for lavatories designated by the Building Owner for the use by the Contractor's personnel, use of existing toilets within the building by the Contractor and his/her personnel shall not be permitted.
  - 2.4 During all phases of the project, two (2) fire exits from any work area shall be maintained, where feasible. The exterior work area shall be demarcated using red asbestos caution tape.
  - 2.5 Unless otherwise noted, all books, files, equipment and other removable objects shall be removed by the Building Owner prior to the commencement of the work.
  - 2.6 The Contractor shall furnish all labor, supervision, materials, services, insurance, equipment and tools necessary for the complete and proper execution of the work.
  - 2.7 All asbestos abatement shall be performed in accordance with the applicable regulations and guidelines of the United States Environmental Protection Agency, the Occupational Safety and Health Administration, the New Jersey Department of Health, the New Jersey Department of Labor, the New Jersey Department of Community Affairs and the New Jersey Department of Environmental Protection.
  - 2.8 Applicable standards listed in these specifications include, but are not limited to, standards promulgated by the following agencies and organizations. In all cases, this specification shall take precedence where it meets or exceeds any Federal, State or Local regulations.

a. A.N.S.I.

American National Standards Institute  
25 West 43rd Street, 4th Floor  
New York, NY 10036

b. A.S.T.M.	American Society for Testing & Materials 100 Barr Harbor Drive P. O. Box C700 West Conshohocken, PA 19428-2959
c. IBC 2000 New Jersey	International Code Council 900 Montclair Road Birmingham, AL 35213
d. U.L.	Underwriters Laboratories 36-42 Newark Street, Unit #502 Hoboken, NJ 07030
e. U.S.E.P.A.	U. S. Environmental Protection Agency – Region 2 Division of Enforcement and Compliance Assistance Air Compliance Branch 290 Broadway, 21st Floor New York, NY 10007-1866
f. N.I.O.S.H.	National Institute for Occupational Safety and Health Region 2, 26 Federal Plaza New York, NY 10007
g. N.F.P.A.	National Fire Protection Association 83 Creek Ridge Pittsford, NY 14534
h. N.I.S.T.	National Institute of Standards & Technology 100 Bureau Drive Gaithersburg, MD 20899
i. O.S.H.A.	Occupational Safety & Health Administration New York Regional Office 1515 Broadway (Astor Plaza), Room 3445 New York, NY 10036
j. D.O.H.	New Jersey Department of Health Consumer and Environmental Health Services P. O. Box 369 Trenton, NJ 08625-0369
k. D.C.A.	New Jersey Department of Community Affairs Asbestos Safety Unit P. O. Box 816 Trenton, NJ 08625-0816
l. D.E.P.	New Jersey Department of Environmental Protection Division of Solid Waste Management Bureau of Compliance and Enforcement P. O. Box 414 Trenton, NJ 08625-0414
m. D.O.L.	New Jersey Department of Labor & Workforce Development Asbestos Control & Licensing Section 1 John Fitch Plaza, 3rd Floor P. O. Box 392 Trenton, NJ 08625-0392

2.9 The Contractor shall assume full responsibility and liability for the compliance with all applicable Federal, State, and Local regulations pertaining to work practices, hauling, disposal and the protection of workers, visitors to the site and persons occupying areas adjacent to the site. The Contractor is responsible for providing medical examinations and maintaining medical records of personnel as required by applicable Federal, State and Local regulations. The

Contractor shall indemnify and hold the Owner and the Owner's representative harmless for failure to comply with any applicable work, hauling, disposal, safety, health or other regulation on the part of themselves, their employees or their subcontractors.

- 2.10 Except to the extent that more stringent requirements are written directly into the contract documents, all applicable codes, regulations and standards have the same force and effect (and are made a part of the contract documents by reference) as if copied directly into the contract documents, or as if published copies are bound herewith.
- 2.11 The Contractor shall strictly adhere to all precautions necessary for the safety and health of the work person in accordance with provisions of OSHA Standards, 26 CFR 1926.58 (Construction Standards) and 26 CFR 1910.1001 (Industry Standards).
- 2.12 The Contractor shall limit the use of the premises to the work indicated.
- 2.13 The Contractor shall keep existing entrances serving the premises clear and available to the Owner and their employees at all times. Do not use these for parking or storage of materials.
- 2.14 The Contractor shall not unreasonably encumber the site with materials or equipment. The Contractor shall confine stockpiling of materials and location of storage sheds to areas approved by the Building Owner or their representatives.
- 2.15 The Contractor shall lock all vehicles and construction equipment, when parked and unattended so as to prevent unauthorized use. The Contractor shall not leave any vehicles or equipment unattended with the motor running or the ignition key in place.
- 2.16 The Contractor shall maintain the existing building in a safe and weather-tight condition throughout the work period, repair all damage caused by abatement/demolition operations and take all necessary precautions to protect the building.
- 2.17 The Contractor shall properly contain, transport and dispose of all contaminated wastes and materials at a site approved for asbestos disposal. No waste storage container shall be placed on the campus. All waste shall be removed from the site daily. If permitted by the Owner or their representatives, properly containered waste may be stored inside the work area only if the area can be secured during the time the Contractor is not on site.
- 2.18 Smoking shall not be permitted in the building or on the premises.
- 2.19 The Contractor shall furnish, install and maintain for the duration of the project all precautions necessary for the safety, health and welfare of the workers and building occupants.
- 2.20 The Contractor shall furnish, install and maintain for the duration of the project all methods and systems necessary to prevent the escape of airborne asbestos fibers to adjacent areas of the building.
- 2.21 The Contractor shall clean, dismantle, remove and replace all items and equipment which should be moved prior to asbestos cleanup, unless otherwise noted.
- 2.22 The Contractor shall dismount all fire, electrical and mechanical fixtures and appurtenances required for proper execution of this contract. A licensed electrician is required and shall be trained in the use of a respirator and handling asbestos materials.
- 2.23 The Contractor shall complete all aspects of the removal as rapidly as progress of the work shall permit. The work on each floor, including clearance air testing and final cleanup procedures, shall be completed within the time frames specified by the Owner. In addition, the Contractor shall be responsible for all labor costs incurred by the Owner for any monitoring work performed on or after the completion date specified by the Owner. The Contractor shall be responsible for all additional labor and sample analysis costs incurred by the Owner for any monitoring work which is performed after the final clearance air samples are collected, in the event that the results of the first set of final clearance are above the re-occupancy threshold.
- 2.24 The Contractor shall neither make nor assert a claim for damage against the Owner by reason of any delays herein mentioned, including without limitation, delays arising out of change orders and agrees that the sole claim in the event of such delays is limited to extension of time for completion of the work.

- 2.25 The Contractor's inability to secure sufficient personnel for the performance of the contract shall not constitute a basis for extension of time.
- 2.26 The Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the work or the incorporation in the work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others including patent rights and copyrights held by the Owner or the Architect. The Contractor shall be solely responsible for all damages, losses and expenses arising out of any infringement of patent rights or copyrights incident to the use and the performance of the work or resulting from the incorporation in the work of any invention, design, process, product or device not specified in the Contract Documents and shall defend all such claims in connection with any alleged infringements of such rights.

### **PART 3.0 – DOCUMENTATION**

- 3.1 The contractor shall submit any and all documents and forms as requested by the Owner or their representatives.

### **PART 4.0 - NOTIFICATIONS**

- 4.1 Where applicable, the Contractor shall notify the following agencies in writing prior to the start of an asbestos abatement project as soon as possible prior to the start of work:
- a. United States Environmental Protection Agency – Region II  
Division of Enforcement and Compliance Assistance  
Air Compliance Branch  
290 Broadway, 21st Floor  
New York, NY 10007-1866
  - b. New Jersey Department of Health  
Consumer and Environmental Health Services  
P. O. Box 369  
Trenton, NJ 08625-0369
  - c. New Jersey Department of Environmental Protection  
Division of Solid Waste Management  
Bureau of Compliance and Enforcement  
840 Bear Tavern Road, P. O. Box 414  
Trenton, NJ 08625-0414
  - d. New Jersey Department of Labor & Workforce Development  
Asbestos Control & Licensing Section  
1 John Fitch Plaza, 3rd Floor  
P. O. Box 392  
Trenton, NJ 08625-0392
- 4.2 This notification shall include the following:
- a. Name and address of Contractor.
  - b. Address and description of the building, including size, age and prior use of the building or areas, the amount of friable asbestos material present, location within building (unless entire building is involved).
  - c. Scheduled starting and completion dates for removal.
  - d. Procedures and equipment (including ventilation systems) that shall be employed to comply with the C.F.R., Title 40, Part 61 of the USEPA.
  - e. The name and address of the carting company and of the waste disposal site where the asbestos waste shall be deposited.
  - f. The name and address of the testing laboratory who shall perform air monitoring on behalf of the Owner, and the name and address for the testing laboratory who shall perform OSHA compliance on behalf of the Contractor.



- 4.3 The Contractor shall notify the following agency in writing prior to the removal of asbestos abatement from the project site and the disposal of asbestos waste. All asbestos waste materials destined for shall be in accordance with 40 CFR 61.20-25 before it can be legally transported and disposed of.

New Jersey Department of Environmental Protection  
Division of Solid Waste Management  
Bureau of Compliance and Enforcement  
840 Bear Tavern Road, P. O. Box 414  
Trenton, NJ 08625-0414

- 4.4 This notification shall include the following:
- a. Name, address and telephone number of the removal project.
  - b. Quantity in cubic yards and nature of the waste to be disposed (I.D. #27 for Asbestos).
  - c. Name, address and NJDEP registration number of the collector/handler.
  - d. Name and address of the disposal site at which disposal will occur.
  - e. Date and time of disposal.
  - f. A copy of any written notification required by 40 CFR 61.22-61.25.

#### **PART 5.0 - PRE-ABATEMENT STATE REQUIREMENTS**

- 5.1 For projects involving the abatement (not including materials removed using the "wrap and cut" method or repair work) of more than ten linear feet and/or twenty-five square feet of **friable** interior asbestos-containing materials, it is unlawful to undertake an asbestos hazard abatement project unless the building Owner or their agent first files an application in writing with the Enforcing Agency and obtains the required permit. This permit shall serve as notice for public record in the office of the Enforcing Agency. All work shall be monitored by the Owner's consultant, who shall advise the Enforcing Agency of its findings.
- 5.2 The application for a construction permit shall include the following information:
- a. The name and address of the Contractor.
  - b. The name and address of the private air monitoring firm hired by the Building Owner. The monitor shall be responsible for the continuous monitoring during the asbestos abatement project.
  - c. The name and address of the analytical testing laboratory which shall analyze bulk, dust and air samples as needed.
  - d. Documentation that the building will only be occupied if the work areas can be properly separated and sealed off from the occupied portion of the building.
  - e. The scheduled starting and completion dates for the abatement project.
  - f. Plans and specifications [not less than four (4) sets] indicating the scope of the proposed work and the provisions proposed to contain the asbestos-containing material during abatement work, showing, but not limited to, separation barriers, primary seal/critical barriers, route of travel of removing asbestos waste from the work site and a floor plan indicating exits.
  - g. The name and address of the waste hauler and the name and location of the landfill where the asbestos shall be deposited.
- 5.3 The issuance of the construction permit for asbestos abatement authorizes only the preparation of the job site.

## **PART 6.0 - DOCUMENTATION REQUIRED AT WORK SITE**

- 6.1 One copy each of the regulations cited in this work plan shall be available in the Contractor's business office and one copy of each shall be maintained at the job site.
- 6.2 Additional documentation to be available at the job site shall include the following:
- a. A sign in black letters greater than four inches (4") in height stating the following:  

"LICENSED BY THE STATE OF NEW JERSEY FOR ASBESTOS WORK"
  - b. The sign shall be displayed prominently outdoors at the worksite.
  - c. A list of emergency phone numbers to include: the monitoring firm employed by the Building Owner, USEPA, OSHA, DOE, local fire, police, hospital and emergency squad.
  - d. Work area emergency procedures posted in plain view inside and outside the work areas. Emergency procedures take precedence over decontamination procedures.
  - e. A list of personnel, including all new employees.
  - f. A daily log of all persons entering the work areas, including all visitors. Persons not employed by the Asbestos Contractor shall be required to sign an acceptable waiver form. The waiver form shall be approved by the Environmental Project Manager.
  - g. The daily log shall include a record of start and stop times, any work problems encountered, any corrective action and estimated amount of asbestos waste generated.
  - h. The Contractor shall be responsible for obtaining a copy of the daily monitoring logs from their air testing firms and maintaining them at the job site.
- 6.3 Work schedules and updated progress charts depicting all phases of the work and completion deadlines shall be maintained on site.
- 6.4 A copy of the Waste Hauler's Certificate and copies of all landfill receipts shall be maintained on site.

## **PART 7.0 - PROJECT REVIEW & INSPECTION**

- 7.1 The Owner, Owner's Representative, Project Manager and the representatives of agencies having lawful jurisdiction shall at all times have access to the work areas whether the work is in preparation or progress.
- 7.2 The Owner reserves the right to stop all removal operations and cancel this contract if proper environmental, health and safety precautions are not being implemented and adhered to by the Contractor and his/her personnel. If work procedures are not in compliance with the specification, a "Stop Work Order" shall be issued to Contractor by the Owner or Project Manager. The Contractor shall not recommence work until authorized in writing to do so by the Owner or their representative. Further noncompliance of these specifications or safety regulations shall be cause for cancellation of the contract.

## **PART 8.0 - PROTECTIVE CLOTHING/EQUIPMENT FOR ABATEMENT**

- 8.1 Listed below are materials, equipment and tools generally used in proper asbestos removal operations. It is not inferred, however, that all materials listed are necessarily required in every asbestos abatement project and, in some instances, materials required to complete the work may not be listed.
- a. Protective clothing: Shall be fire retardant manufactured of "Tyvek" by DuPont (or approved equal) consist of disposable full body coveralls, headcovers and boots as required by the most stringent OSHA standards applicable to the work. Eye protection, hard hats and gloves shall be available.
  - b. Plastic Sheeting: Where needed, provide six (6) mil thick polyethylene sheeting. The polyethylene sheeting shall be taped securely in place, stapled, or fastened by spray-on adhesives, glue beads, horizontal wood battens or the equivalent.

- c. Where work procedures are in view to the public, black or opaque six mil polyethylene shall be utilized on decontamination chambers, windows, etc.
- d. Adhesives: Tape shall be high quality duct tape (or approved equivalent) in 2"-3" widths.
- e. Glove Bags of six mil thickness fitted with long sleeve gloves, a tool pouch and a two inch (2") opening used for water application.
- f. Support Structures shall be constructed of Polyvinyl Chloride Pipes (P.V.C.) and/or aluminum or wood studs.
- g. Disposal bags shall be six (6) mil polyethylene bags of a sufficient size for the application. The bags shall be printed with letters of sufficient size and contrast to be readily visible and legible. The label shall state at a minimum:
 

DANGER  
 Contains Asbestos Fibers  
 May Cause Cancer  
 Causes Damage to Lungs  
 Do Not Breathe Dust  
 Avoid Creating Dust
- h. Caution Signs shall be 14" x 20" in size with a red background and lettered in black. Signs shall be displayed at all routes of access and all visual and physical barriers.

LEGEND	NOTATION
Danger	1" Sans Serif Gothic or Block
Asbestos	1" Sans Serif Gothic or Block
May Cause Cancer	1/2" Sans Serif Gothic or Block
Causes Damage to Lungs	1/2" Sans Serif Gothic or Block
Wear Respiratory Protection and Protective Clothing in this Area	3/8" Sans Serif Gothic or Block
Authorized Personnel Only	3/8" Sans Serif Gothic or Block

All signs shall meet OSHA Standard 29 CFR 1926.58.

- i. At all areas of direct access to the work areas (decontamination unit, etc.), display signs (10" x 14") with yellow background and black lettering as follows:

LEGEND	NOTATION
No Food Beverages or Tobacco Permitted	3/4" Block
All Persons Shall Wear Protective Clothing (Coverings) Before Entering the Work Area	3/4" Block
All Persons Shall Shower Immediately After Leaving Work Area and Before Entering the Changing Area	3/4" Block

- j. Amended water or removal encapsulant shall be approved for the particular type and concentration of asbestos dealt with in each circumstance by the Project Manager. Amended Water is water to which a surfactant has been added. The Contractor shall use a mixture of surfactant and water which results in wetting of the material which equals or surpasses the wetting resulting from the use of one (1) ounce of a surfactant consisting of fifty percent (50%) polyoxyethylene ester and fifty percent (50%) polyoxyethylene ether mixed with five (5) gallons of water.

- k. Removal Sealant: The Contractor shall provide a penetrating-type sealant designed specifically for the removal of asbestos-containing material. The Contractor shall use a material which results in the wetting of the asbestos-containing material and retardation of fiber release during disturbance of the material equal to or greater than that provided by amended water as described above. The sealant shall be tinted and meet all applicable fire and building codes.
  - l. Filters shall be of sufficient quantity and type (HEPA) for use in respirators and other equipment requiring filters.
  - m. The Contractor shall use cleaning materials needed to maintain the specified standard of cleanliness and compatible with the surface being cleaned.
  - n. Respiratory Protection shall be in accordance with OSHA Regulation 1926.58 and ANSI Z88.2-1980. There shall be NO EXCEPTIONS to these requirements.
  - o. Air Filtration Equipment shall be capable of filtering airborne asbestos fibers.
  - p. HEPA Vacuum: The Contractor shall use high efficiency vacuum cleaners with special HEPA filtration to retain asbestos fibers with a capillary tube if to be utilized with a glove bag.
  - q. The Decontamination System shall consist of lockers, showers with pump support, respirator storage, equipment storage, etc.
  - r. Shower Head and Controls: The Contractor shall provide a factory-made shower head producing a spray of water which can be adjusted for spray size and intensity. The shower shall be fed with water mixed from hot and cold water supply lines and be arranged so that the control of water temperature, flow rate and shut off is from inside shower without outside aid.
  - s. Shower Stall: The Contractor shall provide, for the Shower Area, a leaktight shower enclosure (with integrated drain pan) made of fiberglass or other durable waterproof material, approximately 3' x 3' square with minimum 6' high sides and back and shall be structurally supported as necessary for stability. The shower stall shall be equipped with a hose bib, as specified in this section, mounted at approximately 5' above the drain pan. The pan shall be connected to a reservoir, which shall be connected to a storage barrel. The water shall be disposed of with the asbestos-containing material or used for amended water.
  - t. Sump Pump: The Contractor shall install a totally submersible sump pump (with integral float switch) sized to pump two times the flow capacity of all showers or hoses supplying water to the sump through any filters. The pump shall be capable of pumping debris, sand, plaster or other materials washed off during decontamination procedures without damaging the pump and have an adjustable float switch so that a minimum of 3" remains between the top of the liquid and the top of the sump pan.
  - u. Lumber: The Contractor shall provide kiln-dried lumber of any grade or species.
  - v. Scaffold: The Contractor shall provide all scaffolding and/or staging as necessary.
  - w. Hand Tools: The Contractor shall provide all needed hand tools and ancillary materials to properly complete the work.
  - x. Spray Equipment: The Contractor shall provide spray equipment capable of mixing any wetting agent with water and capable of generating sufficient pressure, volume and having ample hose length to reach all areas of asbestos.
  - y. Communication: The Contractor may utilize "Walkie-Talkies" for communication between the work areas and outside areas.
- 8.2 The Contractor shall have available sufficient inventory of these materials and equipment to accomplish the job, protect the workers, and protect all authorized visitors to the job site.
- 8.3 In procuring all items in this work, it is the Contractor's responsibility to verify the detailed requirements of this guideline and all codes, standards and regulations to verify that the items procured for use on this project meet or exceed the specified requirements.
- 8.4 The Owner reserves the right to reject items incorporated into the work that fail to meet the requirements of this guideline or any applicable codes, standard or regulation.

- 8.5 The mention of any product or manufacturer's name or equipment name does not imply endorsement by the Owner, their representative or the project manager.
- 8.6 "Approved equal" or "equal" shall mean as approved by the Owner, their representative or Project Manager only. They shall be the sole judge as to whether or not a substitute item is equal, and any item specified shall be submitted for approval.

## **PART 9.0 - RESPIRATORY PROTECTION**

### 9.1 Powered Air-Purifying Respirators

- a. Powered air-purifying, positive pressure, full or half-face respirators shall be worn during all phases of the project. If air monitoring results show that fiber counts meet or exceed an action level defined as one-half (1/2) the respirator use limit concentration (50 f/cc), then Type "C" respirators shall be used.
- b. The Contractor shall supply a sufficient quantity of high efficiency respirator filters approved for asbestos so that workers can change filters at any time that flow through the face piece decreases to the level at which the manufacturer recommends filter replacement. HEPA elements in filter cartridges shall be protected from wetting during showering. The entire exterior housing of the respirator including the blower unit, filter cartridges, hoses, battery pack, face mask, belt and cord is to be washed each time a worker leaves the work area. Caution should be taken to avoid shorting the battery pack during the washing. The Contractor shall provide an extra battery pack for each respirator so that one can be charging while one is in use.
- c. Respirator Bodies: The Contractor shall provide full-face type respirators and equip full-face respirators with a nose cup or other anti-fogging device as would be appropriate for use in air temperatures less than 32° F.
- d. Filter Cartridges: The Contractor shall provide, at a minimum, HEPA type filters labeled with NIOSH and MSHA Certifications for "Radionuclides, Radon Daughters, Dust, Fumes, Mists including Asbestos-Containing Dusts and Mists" and color coded in accordance with ANSI Z228.2 (1980). In addition, a chemical cartridge may be added, if required, for solvents, etc. in use. In this case, the Contractor shall provide cartridges that have each section of the combination canister labeled with the appropriate color code and NIOSH/MSHA Certification.
- e. Do not use single, disposable or quarter-face respirators. Negative pressure half-face respirators may only be used in conjunction with proper eye protection.

### 9.2 Fit Testing

- a. The Contractor shall provide initial fitting of respiratory protection during a respiratory protection course of training, set-up and administered by an Asbestos Safety Instructor, fit types of respirators to be actually worn by the individual and allow an individual to use only those respirators for which he/she has been trained and fitted.
- b. The Contractor shall check the fit of each worker's respirator by having irritant smoke blown onto the respirator and into the intake port of the motor unit (with the filters in place) from a smoke tube.
- c. The Contractor shall require that each time an air-purifying is put on, it is checked for fit with a positive pressure fit test in accordance with the manufacturer's instructions or ANSI Z88.2 (1980).

## **PART 10.0 - CONSTRUCTION AIDS**

- 10.1 The Contractor shall provide all scaffolding, ladders or staging equipment, etc. as necessary to accomplish the work of this contract. Scaffolding may be of suspension type, or standing type such as metal tube and coupler, tubular welded frame, pole or outrigger type or cantilever type. The type, erection and use of all scaffolding shall comply with all applicable OSHA provisions.
- 10.2 During the erection and/or moving of scaffolding, care shall be exercised to avoid damage to the polyethylene floor.
- 10.3 The rungs of all metal ladders, etc., shall be equipped with an abrasive non-skid surface.
- 10.4 All surfaces subject to foot traffic shall have a nonskid surface. Surfaces shall be cleaned as required to remove slippery materials.

- 10.5 At the completion of the removal work, all construction aids shall be cleaned within the work areas and wrapped in one (1) layer of six mil polyethylene sheet and sealed before the work areas.

### **PART 11.0 - AIR FILTRATION SYSTEM**

- 11.1 The Contractor shall supply the required number of asbestos air filtration units to the site in accordance with this specification.
- 11.2 The Air Filtration Unit cabinet shall be constructed of steel or other durable materials able to withstand the damage from rough handling and transportation. The width of the cabinet should be less than thirty inches (30") to fit through standard doorways. The cabinet shall be factory sealed to prevent asbestos-containing dust from being released during use, transport or maintenance. Access to and replacement of all air filters shall be from the intake end. The unit shall be mounted on casters or wheels.
- 11.3 The Air Filtration Unit fans shall be rated according to usable air moving capacity under actual operating conditions and shall be centrifugal-type.
- 11.4 The final filter of the unit shall be a HEPA filter. The filter media (folded into closely pleated panels) shall be completely sealed on all edges with a structurally rigid frame.
- a. A continuous rubber gasket shall be mounted between the filter and the filter housing to form a tight seal.
  - b. Each filter shall be individually tested and certified by the manufacturer to have an efficiency of not less than 99.97% when challenged with 0.03 micron dicytolphthalate (D.O.P.) particles. Testing shall be in accordance with Military Standard Number 282 and Army Instruction Manual 136-300-175A. Each filter shall bear a UL586 label to indicate ability to perform under a specified condition.
  - c. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance and the direction of the air flow.
- 11.5 Two stages of prefilters are required in order to protect the final filter by removing larger particles, thus prolonging the life the operating life of the HEPA filter. The first stage prefilter shall be a low efficiency filter [for particles ten (10) microns or larger]. The second stage filter shall have a medium efficiency [for particles as small as five (5) microns]. Prefilters and intermediate filters shall be installed either on or in the intake grid of the unit and beheld in place with special housing or clamps.
- 11.6 Each Air Filtration Unit shall be equipped with a Magnehelic gauge or manometer to measure the pressure drop across filters and indicate when filters have become loaded and need to be changed. A table indicating the usable air handling capacity for various static pressure readings on the Magnehelic gauge shall be affixed near the gauge for reference, or the Magnehelic reading indicating at what point the filters should be changed, noting cubic feet per minute (CFM) air delivery at that point. The units shall be equipped with an elapsed-time meter to show the total accumulated hours of operation.
- 11.7 Each unit shall have an electrical (or mechanical) lockout to prevent the fan from operating without a HEPA filter. Units shall be equipped with automatic-shutdown systems to stop the fan in the event of a major rupture in the HEPA filter or blocked air discharge. Warning lights are required to indicate normal operation, a high pressure drop across the filters (filter overloading) and a low pressure drop (major rupture in HEPA filter or obstructed discharge).
- 11.8 All units shall have electrical components which are approved by the National Electrical Manufacturers Association (NEMA) and Underwriters Laboratories (UL). Each unit shall be equipped with overload protection, sized specifically for the equipment. The motor, fan, fan housing and cabinet shall be grounded.
- 11.9 Fully operational air-filtration systems shall provide a minimum of four (4) air changes every one (1) hour. The volume in cubic feet shall be calculated by multiplying the floor area by the ceiling height. The total ventilation requirement in cubic feet per minute (CFM) shall be calculated by for the work area by dividing this volume by the air change rate.

$$\text{Ventilation Requirement (CFM)} = \frac{\text{volume of work area}}{\text{fifteen (15) minutes}}$$

11.10 The number of units needed to achieve a fifteen (15) minute-change rate shall be determined by dividing the ventilation requirement (CFM) above by the capacity of the exhaust units used.

$$\text{Number of units needed} = \frac{\text{ventilation requirement (CFM)}}{\text{capacity of unit (CFM)}}$$

One (1) additional unit shall be maintained on site as a backup in case of equipment failure or machine shutdown for filter changing.

11.11 The Contractor shall provide a sufficient number of air filtration devices in order to maintain an exhaust capacity sufficient to establish and maintain a pressure differential between the work area and all adjacent spaces greater than or equal to 0.03 inches w. c. for unoccupied buildings or 0.05 inches w. c. for occupied buildings.

11.12 Where required, pressure differential shall be constantly monitored using manometers. One or more separate pressure monitoring devices shall be installed near the entrances to the work area and any interior spaces from which make-up air is drawn. The Contractor shall be responsible for providing all needed manometers or other pressure monitoring devices. All manometers shall have electronic digital readouts and a continuous tape printout.

11.13 The air filtration units shall be located so that the makeup air enters the work area primarily through the decontamination facilities or controlled makeup air inlets (if allowed by regulation) and traverses the work areas as much as possible. The location of the units shall be at a maximum distance from the worker access opening or other makeup air sources

- a. The end of the unit or its exhaust duct shall be placed through an opening in the plastic barrier or wall covering. The plastic around the unit or duct shall be sealed with duct tape and any exterior exhaust port shall be protected with a cage to prevent vandalism.
- b. The unit shall always be exhausted to the outside of the building, unless authorized in writing by the Owner's representative or Environmental Project Manager. Do not vent into the nonwork areas of the building.

11.14 If allowed by regulation, controlled makeup air inlets shall be provided where required for proper air flow through the work areas in locations approved by the Owner's representative and the Environmental Project Manager. The Contractor shall make openings in the polyethylene sheeting that allows air from outside the building into the work area if applicable and locate the auxiliary makeup air inlets as far as possible from the exhaust unit(s), off the floor, and away from the barriers separating the work area from occupied, clean areas.

11.15 Each unit shall be serviced by a dedicated minimum 115V-20A circuit with overload device tied into an existing building electrical panel which has sufficient spare capacity to accommodate the load of all units connected.

11.16 The air filtration system shall be tested before any asbestos-containing material is wetted or removed. After the work area has been prepared, the decontamination facility set up and the exhaust units installed, the units shall be started one at a time. The test of the system shall include:

- a. Plastic barriers and sheeting move slightly in towards the work area;
- b. Curtains of the decontamination unit move slightly towards the work area;
- c. There is a noticeable movement of air through the decontamination unit.
- d. The use of smoke tubes shall demonstrate a positive motion of air across all areas in which work is to be performed.

11.17 The air filtration system shall be used as follows:

- a. The units shall be started before beginning work. After removal has begun, the units shall be run continuously to maintain constant air flow until decontamination of the area is complete. The units shall not be turned off at the end of the work shift or when removal operations temporarily stop.
- b. The system shall not be shut down during application of the sealant procedures, unless authorized by the Owner's representative or Environmental Project Manager in writing.

- c. Removal shall start at a location farthest from the units and proceed toward them. If an electrical power failure occurs, removal shall stop immediately and not resume until power is restored and the units are operating again.
- d. At the completion of the removal work, the units shall be allowed to run in order to remove airborne fibers that may have been generated during wet removal and cleanup and to purge the work area with clean makeup air. The units may be required to run for a longer time after decontamination, if dry or only partially wetted asbestos material was encountered during removal.

11.18 When a final visual inspection and the results of final air tests indicate that the area has been decontaminated, the exhaust units may be removed from the work areas. Before removal from the work areas, the unit shall have the pre- filter removed and disposed of properly, and the intake to the machine shall be sealed with six (6) mil polyethylene to prevent environmental contamination from the filters.

## **PART 12.0 - PROTECTION OF WORKERS AND SITE VISITORS**

- 12.1 Respirators, disposable coveralls, head covers and footwear covers shall be provided by the Contractor for the Owner, their representative, the Project Manager and other authorized visitors who may inspect the jobsite. The Contractor shall provide two (2) respirators and six (6) complete coveralls and, where applicable, six (6) respirator cartridges per day. Sufficient HEPA cartridges for powered air-purifying respirators shall be provided for the workers to change during the work shift. No HEPA cartridges shall be used for longer than three (3) work shifts (one work shift equals eight hours). RESPIRATORS SHALL BE WORN AT ALL TIMES WHEN IN THE CONTAMINATED AREA. THERE WILL BE NO EXCEPTIONS.
- 12.2 In accordance with NIOSH, OSHA and ANSI regulations, the Contractor shall have a formal respirator-use program that, at a minimum, shall consist of the following:
- a. Written standard operating procedures governing the selection and use of respirators;
  - b. Details on the selection of respirators on the basis of the hazards to which the worker is exposed;
  - c. Instruction and training procedures for the proper use respirators and their limitations;
  - d. Procedures for the assignment and fit testing of respirators to individual workers for their individual use;
  - e. Procedures for regularly cleaning and disinfecting respirators after each use;
  - f. Procedures for storage of respirators and filters in a convenient, clean and sanitary location;
  - g. Procedures for inspecting respirators during cleaning;
  - h. Procedures for maintaining appropriate surveillance (monitoring) of the work area and degree of employee exposure and stress;
  - i. Procedures for regular inspection and evaluation of the effectiveness of the program;
  - j. Workers shall not be assigned to tasks involving the use of respirators unless it has been determined that they are physically able to perform the work and use the equipment;
  - k. All respirators shall be approved, accepted and recommended.
- 12.3 The Contractor shall guarantee that all employees have participated and are currently participating in the respirator use program.
- 12.4 The Contractor shall provide full body protective clothing to workers and visitors, which shall be worn at all times when in the contaminated area.
- 12.5 All protective clothing shall be disposed of when leaving the contaminated area and a new set used upon return to the contaminated area.



- 12.6 There shall be no smoking, eating, drinking or removal of respirators for any reason in any contaminated areas (shower room, equipment room, contaminated change room and work area). Persons violating this specification shall be denied access to the work area for any reason.

### **PART 13.0 - EMERGENCY PRECAUTIONS**

- 13.1 The Contractor shall prepare a contingency plan for emergencies including fire, accident, power failure, air filtration system failure, supplied air system failure or any other event that may require modification or abridgement of decontamination or work area isolation. No provision of this specification should impede safe exiting or provision of adequate medical attention in the event of an emergency.
- 13.2 The Contractor shall provide barricades and adequate protection to safely prevent passage of persons to the area of removal and prevent accidental entrance to the abatement area by any building occupants.
- 13.3 Before the Contractor starts actual abatement of asbestos material, the local fire department and ambulance crews shall be notified as to the dangers of entering the work area. The Contractor shall make every effort to assist these agencies and form plans of action should their personnel need to enter the contaminated area.
- 13.4 Local medical emergency personnel, both ambulance crews and hospital emergency room staff, shall be notified as to the possibility of having to handle injured workers who are contaminated with asbestos dust. They shall be advised on safe decontamination procedures.
- 13.5 First aid shall comply with the governing regulations and all recognized recommendations within the construction industry.
- 13.6 When an event of unusual and significant nature occurs at the site (i.e. failure of the air filtration system, rupture of temporary enclosures, etc.), the Contractor shall prepare and submit a special report listing the chain of events, persons participating, response by the work crew, results of their actions and other related information. When such events are known or predictable, the Contractor shall advise the Owner in advance at the earliest possible date.
- 13.7 The Contractor shall prepare and submit reports of significant accidents at the site and anywhere else work is in progress. For this purpose, a significant accident is defined to include events where personal injury is sustained, or property loss of substance is sustained, or where the event posed a significant threat of loss or personal injury.

### **PART 14.0 - TEMPORARY SERVICES**

- 14.1 The Contractor shall provide temporary connection to existing building facilities or provide temporary facilities as required herein or as necessary to carry out the work.
- 14.2 Water Service shall be utilized as follows:
- a. All connections to the Owner's water system shall include backflow protection. Valves shall be temperature and pressure rated for operation of the temperatures and pressures encountered. After completion of use, connections and fittings shall be removed without damage or alteration to the existing water piping equipment. Leaking or dripping valves shall be piped to the nearest drain or located over an existing sink or grade where water shall not damage existing finishes or equipment.
  - b. The Contractor shall employ heavy-duty abrasion-resistant hoses with pressure rating greater than the maximum pressure of the water distribution system to provide water to each area and to each decontamination unit and provide fittings, as required, to allow for connection to existing wall hydrants or spouts as well as temporary heating equipment, branch piping, showers, shut-off nozzles and equipment.
  - c. Hot water may be secured from the building's hot water system provided backflow protection is installed at the point of connections described in this section and if authorized by the Owner and their representative.
- 14.3 Temporary electrical service shall be utilized as follows:
- a. The Contractor shall provide service to the decontamination unit sub-panel with a minimum sixty (60) amp, two (2) pole circuit breaker or fused disconnect connected to the building's main distribution panel. The sub-panel and disconnect shall be sized and equipped to accommodate all electrical equipment required for completion of the work.

- b. The Contractor shall provide identification warning signs at power outlets which are other than 110-120 volt power and provide polarized outlets for plug-in type outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Dry type transformers shall be provided, where required, to provide voltages necessary for work operations.
  - c. The Contractor shall provide receptacle outlets equipped with ground-fault circuit interrupters, reset button and pilot light for plug-in connection of power tools and equipment.
  - d. The Contractor shall use only grounded extension cords and use "hard-service" cords where exposed to abrasion and traffic. The Contractor shall only use single-length cords or waterproof connectors to connect separate lengths of electric cords, if single lengths shall not reach areas of work.
  - e. The Contractor provide incandescent lamps of wattage required for adequate illumination and protect the lamps with guard cages or tempered-glass enclosures where fixtures are exposed to breakage by construction operations. Exterior fixtures shall be provided where existing fixtures are exposed to moisture.
- 14.4 The Contractor shall provide type "A" fire extinguishers for temporary offices and similar spaces where there is any danger of electrical or grease-oil-flammable liquid fires. In other locations, type "ABC" extinguishers or a combination of several extinguishers of NFPA-recommended types for the exposure in each case shall be provided. The extinguishers shall also comply with the applicable recommendations of NFPA Standard 10 "Standard for Portable Fire Extinguishers." The Contractor shall provide not less than one extinguisher in each work area in the equipment room of the decontamination unit and one (1) outside the work area in the clean room. If there is to be any use of cutting torches, one worker shall maintain a fire watch in each area, constantly having immediate access to an extinguisher.

#### **PART 15.0 - DECONTAMINATION PROCEDURES**

- 15.1 Where required, the Contractor shall provide an adequate decontamination unit consisting of a serial arrangement of rooms or spaces adjoining the work area or a decontamination trailer. Each airlock shall be clearly identified and separated from the others by plastic crossover sheet doors designed to minimize fiber and air transfer as people pass between areas. A minimum of two (2) layers of six (6) mil polyethylene shall be required for floors, walls and the ceiling for the on-site constructed decontamination units. Plastic cross-over sheet doors shall have at least three layers of six mil polyethylene sheets and be weighted so as to fall into place when people pass through the area. Decontamination chamber doors shall be of sufficient height and width to enable replacement of equipment that may fail and to safely stretch or carry an injured worker from the site without the destruction of the chamber or unnecessary risk to the integrity of the work area. Such doorways must be at least four feet (4') wide and the distance between each set of flaps must be at least four feet (4') apart. Any alternative methods to the use of cross-over polyethylene sheet doors, including louvered or flapped swinging doors, must be approved by the Owner or its representative. Alternative doors shall swing in both directions.
- 15.2 The Personnel Decontamination Unit shall be constructed as follows:
- a. A Changing Room shall be provided for the purpose of changing into protective clothing. It shall be constructed using polyethylene sheeting (minimum: six-mil in thickness) and located in a manner such that access shall to the work area shall be from the changing room through the shower room. If both males and females utilize the decontamination unit, black or opaque polyethylene shall be utilized. This room shall be separated from the building by three interlocking weighted flaps made of six-mil polyethylene.
  - b. In this room, the worker shall leave all street clothes and dress in clean disposable coveralls and put on respiratory protection. No asbestos-contaminated items shall be allowed to enter this room. Workers shall enter this room either from outside the structure dressed in street clothing or naked from the showers.
  - c. A suitable existing room may be used as the changing room if it is suitably located and a configuration whereby workpersons may enter the changing room directly from the shower room. Authorization for this shall be obtained from the Owner's representative in writing prior to the start of work.
  - d. The floor of the changing room shall be kept dry and clean at all times. Overflow water from shower shall not be allowed to wet the floor in the changing room.
  - e. All surfaces in the change room shall damp wiped twice after each shift with a disinfectant solution.

- f. An adequate supply of bath towels shall be available at all times.
- g. The Contractor shall post information for all emergency phone numbers and procedures and provide storage lockers for employees.
- h. The Contractor shall construct a Shower Room used for transit by cleanly dressed workers entering the work area from the outside or by workers headed for the showers after undressing in the equipment room. This room shall be separated from the clean room and equipment room by three (3) interlocking weighted flaps made of six-mil polyethylene. The Contractor shall provide a fully operational portable shower and temporary extensions of existing hot and cold water and drainage, as necessary, to properly operate this shower. If males and females both use the shower, the shower room shall be constructed of black or opaque polyethylene.
- i. An adequate supply of soap and shampoo shall be available at all times and the shower shall be maintained in a sanitary condition.
- j. The shower shall be arranged in a manner as to prevent water from splashing into the clean room.
- k. The water shut off and drain pump operation controls shall be arranged so a single person may shower without assistance from either inside or outside the work area. The shower shall have a stationary adjustable shower head with hot and cold water controls. A garden hose gun is NOT acceptable.
- l. The shower stall shall be constructed of fiberglass or some other permanent material. The shower stall shall not be constructed of polyethylene. The stall shall be a step-through type with an opening at least four feet (4') to allow emergency access to the work area.
- m. The shower must have a drainage basin with a pump to prevent overflow. The shower shall have a platform to stand on. No standing in water shall be permitted.
- n. The Contractor shall construct an Equipment Room used for transit by cleanly dressed workers entering the work area from the outside or by workers headed for the showers after exiting from the work area. This room shall be separated from the work area and shower room by three (3) interlocking weighted flaps made of six-mil polyethylene. The Contractor shall leave work equipment, footwear and additional contaminated work clothing in this area. If males and females both use the decontamination unit, the equipment room shall be constructed of black or opaque polyethylene.
- o. The work area shall be separated from the equipment room by three (3) interlocking weighted flaps made of six-mil polyethylene. The Contractor shall damp wipe clean all surfaces after each shift change to prevent the buildup of debris on the polyethylene.
- p. Arrows shall be placed on all weighted flaps in the decontamination unit to indicate the direction of the overlap and travel.
- q. If any decontamination unit is located within an area containing asbestos-containing material on overhead ceilings, ducts, piping, etc., the decontamination unit shall be constructed with a plywood ceiling (at least 1/4" thick) covered with at least one layer of six-mil thick polyethylene.
- r. Where the decontamination area is immediately adjacent to and/or within view of occupied areas, a visual barrier of six-mil thick sheet of opaque polyethylene shall be constructed in order to maintain worker privacy and shield the work activities from view. If the area adjacent to the decontamination area is accessible to the public, the Contractor shall construct a solid barrier on the public side of the sheeting to protect it. This barrier shall be constructed of 1/2 inch thick plywood and wood or metal studs and covered with two layers of six-mil polyethylene on each side.
- s. The Contractor shall provide a subpanel at the changing room or a location approved by the Environmental Project Manager to accommodate all needed equipment. The source of power shall come directly from a building electrical panel. All electrical branch circuits shall be connected to ground-fault circuit protection devices.

15.3 The decontamination sequence is as follows:

- a. The workers shall enter the work area in the following manner:

1. The worker enters the change room and removes street clothing, puts on clean disposable coveralls and respirator and passes through the shower room into the equipment room.
2. Any additional clothing and equipment left in the equipment room and required by the worker is put on. These items shall be treated as asbestos-contaminated.
3. The worker then proceeds to the work area.

b. The workers shall exit the work area in the following manner:

1. Before leaving the work area, the worker shall remove all gross debris from coveralls and feet.
2. The worker then proceeds to the equipment room and removes all clothing except for respiratory protection equipment. Extra work clothing may be stored in the contaminated end of the equipment room. Disposable clothing shall be placed in a bag for disposal with other contaminated material.
3. After showering, the worker proceeds to the change room and dresses in either new coveralls for another entry into the work area or street clothes if exiting the site.

15.4 All workers shall adhere to the following personal decontamination procedures when exiting the work area:

a. When exiting the area, the worker shall remove disposable coveralls, disposable head covers, disposable footwear in the equipment room. Still wearing a respirator, the worker MUST proceed to the shower and adhere to the following procedure:

1. The worker shall thoroughly wet the body including hair and face. If using a PAPR, the worker shall hold the blower unit away from the water to keep the unit dry.
2. With the respirator still in place, the worker shall thoroughly wash the body, hair, respirator facepiece and all parts of the respirator (except the blower unit and battery pack of a PAPR).
3. The worker shall take a deep breath and remove the respirator after completely wetting the hair, face and respirator. After removing the respirator, the worker shall wash the face piece inside and out.
4. The worker shall shut off the PAPR, cap the inlets to the cartridges, thoroughly wash the blower unit and hoses and wash the battery pack with a wet rag. Do not get water in the battery pack or it will short out and destroy the battery.
5. The worker shall shower completely with soap, shampoo and water and rinse thoroughly.

b. The worker shall rinse off the shower room walls and floor prior to exit and proceed from the shower to the change room.

15.5 A Waste or Equipment Decontamination Unit may be constructed if needed. This type of decontamination unit shall consist of one (1) chamber four feet by four feet in size (4' x 4'), constructed of two (2) layers of six-mil polyethylene mounted on wood or metal studs.

a. The first room shall be a Wash Room. This shall be for cleaning of bagged or packaged asbestos-containing waste materials passed from the work area. This room shall contain a hose to clean the material. This room shall be separated from the work area by a doorway with three (3) interlocking weighted flaps made of six-mil polyethylene.

b. Equipment or material shall be taken from the work area through the Equipment Decontamination Unit as follows:

1. In the wash room, the contaminated equipment or sealed polyethylene bags shall be cleaned and passed through the clean room. All sealed waste bags are placed in another clean bag and passed to workers on the exterior of the building for placement in the waste container. All clean equipment shall be placed in an area away from the work area.
2. AT NO TIME SHALL ANY WORKERS PASS THROUGH THE WASTE DECONTAMINATION UNIT WHILE ENTERING OR EXITING THE WORK AREA!

- 15.6 Debris and residue shall be cleaned from the inside of the decontamination units and from the shower pans on a daily basis. After each shift change, all surfaces shall be damp wiped or hosed down. If the change room of the personnel decontamination becomes contaminated with asbestos-contaminated debris, the entire decontamination unit shall be sealed off and abandoned and a new decontamination unit shall be erected with the former changing room used as the new equipment room.

## **PART 16.0 - WORK AREA PREPARATION**

- 16.1 The "work area" is the area where the abatement of asbestos-containing materials is to occur. The work area is considered to be contaminated during the abatement work and shall be isolated from the rest of the building and decontaminated at the completion of the asbestos abatement work.
- 16.2 The Contractor shall completely isolate the work area from other parts of the building so as to prevent asbestos-containing dust or debris from passing beyond the work area(s). Should the area beyond the work area(s) become contaminated with asbestos-containing dust or debris as a consequence of the work, the Contractor shall clean those areas at no additional cost to the Building Owner.
- 16.3 The Contractor shall place all tools, scaffolding, staging, etc. necessary for the work in the area to be isolated prior to the erection of the plastic sheeting and temporary enclosure.
- 16.4 Employees of the Contractor permitted pursuant to N.J.A.C. 8:60 and N.J.A.C. 12:120 or persons employed by the Building Owner, who have successfully completed a maintenance/custodial/worker training course approved by the NJDOH, unless the room and objects within it are shown to be uncontaminated by asbestos in which case other employees of the Building Owner or Contractor may be used, shall clean with wet cloths and/or HEPA vacuums as appropriate all items that can be removed from the work area without disrupting the asbestos material, unless the room and objects within it are shown to be uncontaminated by asbestos in which case other employees of the Building Owner or Contractor may conduct the cleaning. This shall include furniture, equipment, drapes and curtains. The cloths used for cleaning shall be disposed of as asbestos-contaminated waste.
- 16.5 In accordance with applicable Federal or State regulations, the Building Owner shall clean and remove all uncontaminated removable merchandise, equipment and/or supplies from the work area before commencing work and completely cover them with two (2) layers of six-mil polyethylene securely held in place with duct tape. Such merchandise and equipment shall be considered outside the work area unless the covering plastic or the seal is breached.
- 16.6 The Contractor shall put warning signs at all physical and visual barriers.
- 16.7 Before continuing with any work in preparing temporary enclosures, the Contractor shall provide workers with respiratory protection.
- 16.8 Critical barriers shall be constructed as follows:
- a. The Contractor shall separate the work area from other portions of the building and exterior with 2" wide caution tape and warning signs.
  - b. The entrance into a work area shall have three weighted interlocking flaps constructed of six mil polyethylene.
  - c. All ventilation openings, lighting fixtures, doorways, windows, skylights, convectors, floor drains and other openings shall be sealed with two (2) layers of six-mil polyethylene sheeting and/or duct tape. These seals shall be maintained until all work, including project decontamination, is completed. Care shall be taken in sealing lighting fixtures to avoid melting or burning of sheeting.
  - d. If needed, sheet plastic shall be mechanically supported independently of tape or spray cement seals so that the seals do not support the weight of the plastic, by mounting plywood squares (6" x 6" x 3/8") shall be mounted on the tape and plastic at each end corner at a maximum of four feet on centers and held in place with one 6d smooth masonry nail or electra galvanized common nail driven through the center of the plastic.
- 16.9 Where required, the Contractor shall construct a proper Decontamination Unit and install a proper Air Filtration System.

- 16.10 The Contractor shall clean housings and ducts of all dust/dirt materials prior to the erection of the primary seal/critical barrier polyethylene sheeting.
- 16.11 All electrical and mechanical items such as lighting fixtures, clocks, diffusers, registers, electric panels, escutcheon plates, etc. which cover any part of the surface to be worked on shall be removed or properly sealed with two (2) layers of fire-rated six (6) mil polyethylene.
- 16.12 If the enclosure barrier is breached in any manner that could allow the passage of asbestos debris or airborne fibers, the affected area shall be added to the work area and enclosed in a manner the same as the work area.
- 16.13 Any free-standing containment barriers or tunnels shall be constructed of three (3) layers of six (6) mil polyethylene mounted on 2" x 4" studs placed 16" o. c. apart. Furring strips shall be used as needed.
- 16.14 The breezeway area where plaster removal is to occur shall be prepared under full containment conditions. The Contractor shall install two (2) layers on six-mil polyethylene on the floor of the work area. The first (bottom) layer of floor polyethylene shall extend up the wall to a distance of twelve inches (12") from the floor and the second (top) layer of floor polyethylene shall extend up the wall to a distance of twenty-four inches (24"). The layer of wall polyethylene shall overlap the floor polyethylene by eighteen inches (18"). The layers of wall and floor polyethylene shall be sized to minimize the number of seams and prevent seams from being located in corners.

## **PART 17.0 - WET REMOVAL OF ASBESTOS-CONTAINING OR ASBESTOS-CONTAMINATED MATERIALS**

- 17.1 Wet removal of asbestos-containing and asbestos-contaminated materials shall be conducted as follows:
- a. Any changes to this procedure shall be in writing from the Environmental Project Manager.
  - b. Prior to and during the abatement, all asbestos-containing and asbestos-contaminated materials shall be misted with amended water, which shall aid in minimizing fiber release during work. The material shall be wetted as necessary to ensure that the material is thoroughly wetted throughout.
  - c. A fine, low-pressure spray of amended water or removal sealant shall be applied to prevent fiber disturbances prior to removal. The use of high revolutions per minute (RPM) power equipment, pressure washers or hydro- blasters is prohibited.
  - d. Work shall start in areas nearest to the decontamination unit and work towards the air filtration units.
  - e. Removal of the asbestos material shall be done in small sections by two-person teams, on staging platforms, if needed. The wet material from each section shall be packed and sealed in six-mil plastic bags. When possible, one worker will remove and hand sections of the material to the other worker who will place the material in bags.
  - f. All water-soaked material shall be picked up and bagged before it dries to prevent water loss due to evaporation. The Contractor shall maintain good housekeeping practices throughout the duration of the project.
  - g. Contaminated material with sharp edged items shall be cut to size while adequately wet, placed in small cardboard boxes and double-bagged, or single-bagged and placed in fiber drums.
  - h. Bags and drums shall be marked with the label prescribed in Section 61.22(c) of the EPA regulations. The outside of all containers shall be wet cleaned or HEPA vacuumed before leaving the work area.
  - i. After removal, the underlying material shall be brushed with a stiff, nylon bristle brush. WIRE BRUSHES ARE NOT PERMITTED. After the substrate is brushed, it shall be wet wiped with amended water.
  - j. If at any time the airborne fiber level inside the isolated work area exceeds exceeds 0.1 f/cc (action level), the work shall stop immediately and air cleaning, wetting and surface cleaning procedures shall be implemented.
  - k. The first worker to enter the removal area at the beginning of each work day shall carefully wet the walls and floors with a fine mist of amended water in order to moisten and residues which may have dried from the previous day.
  - l. All free water (in contaminated areas) shall be retrieved and added to asbestos-contaminated waste and/or placed in plastic lined leak-tight drums and/or solidified with an acceptable polymer.

## **PART 18.0 - INTENTIONALLY OMITTED SECTION**

### **PART 19.0 - APPLICATION OF SEALANT**

- 19.1 The sealant shall be an asbestos-binding compound or approved equal.
- 19.2 Application of sealant shall proceed as follows:
- a. After completion of the cleaning of all surfaces in the work area, the Contractor shall spray coat all dried exposed surfaces with a sealant. The color of this coat shall be separate and distinct from the underlying substrate. The surfaces to be coated shall include surfaces from which asbestos-containing materials have been removed and the polyethylene which has been used to cover walls, floors, non-removable fixtures and equipment.
  - b. Two (2) coats of the sealant shall be applied to the substrate after all asbestos-containing material has been removed. Application of the sealant shall be with an airless spray gun and shall be in strict accordance with the manufacturer's instructions.

### **PART 20.0 - CLEANUP PROCEDURES**

- 20.1 At the completion of the asbestos abatement work, all gross debris generated by the asbestos abatement work will have been removed and disposed of.
- 20.2 At the commencement of the cleanup work, the primary protection barriers, the separation barriers between the work area and non-work areas, primary seals on fixtures, doorways, vents, etc., all decontamination units and the air filtration devices shall be in place and fully operational.
- 20.3 The first cleaning of all surfaces in the work area, including items of the remaining sheeting, tools, scaffolding and/or staging equipment shall be done by damp cleaning and mopping and/or vacuuming with a high efficiency particulate (HEPA) filtered vacuum. No dry dusting or sweeping shall be permitted and all cloths used in the cleaning shall be disposed of as asbestos-containing material. This cleaning shall be continued until there is no visible debris from removed materials or residue on plastic sheeting or other surfaces.
- 20.4 After cleaning, the Contractor shall wait a sufficient amount of time to allow the surfaces to dry and to allow the air filtration machines to clean the air. The air filtration machines shall remain in operation at all times.
- 20.5 After the sealant has been applied and allowed to dry, any polyethylene used to cover the ceilings, floors, walls, fixtures and equipment shall be carefully removed and rolled up with the contaminated portion inside. All equipment, machinery, scaffolding, tools, etc., within the isolated work area shall be cleaned with amended water, moved to the equipment room and properly removed from the work area.
- 20.6 After the removal of the polyethylene, a final cleaning of the area shall be done. All surfaces shall be cleaned, allowed to dry and cleaned again. Used cloths and sponges shall be disposed of as contaminated waste. Air filtration units shall remain in operation at all times and sufficient time shall be allotted to allow all surfaces in the area to dry.
- 20.7 If the area is found to visually clean, the air monitoring technician shall perform re-occupancy sampling. If the reoccupancy standard(s) [0.010 fibers per cubic centimeter for each of five (5) samples taken within the work area and/or an average of 70 structures per square millimeter for five samples taken within the work area] is/are not met, final cleaning and air testing procedures shall be repeated. If the re-occupancy standards are met, the Contractor shall remove the critical barriers separating the work area from the rest of the building, clean with amended water all areas where the barriers were attached and remove the air filtration system.
- 20.8 Where required, post-removal samples shall be taken and analyzed by Phase Contrast Microscopy (PCM), using the method outlined in the NIOSH Method 7400.
- a. After the work area is clean, post-removal sampling shall be done in order to establish that conditions are safe for the removal of the critical barriers and the re-occupancy of the area. Sufficient time shall be allowed for the drying of the surfaces. All air filtration units shall be in operation during the monitoring.
  - b. During the monitoring, normal occupancy conditions shall simulated using propeller fans or leaf blowers. Fans shall be placed in all areas to be sampled so as to cause settled fibers to rise and enter the air. All fans shall have fan blades with a radius of at least one foot and shall be capable of creating a minimum air velocity of 500 feet per

minute and may be of the oscillating type. Sampling pumps and media shall be placed 20-40 feet at a right angle from the line(s) of air flow created in front of the fan. The leaf blower and its use must meet the criteria set forth in EPA Document 560/5-85-024, Guidance for Controlling Asbestos-Containing Materials in Buildings, appendix section M.1.5., or any replacement criteria set forth by the USEPA. Their use should be restricted to general occupancy areas, and they should not be used in any space with an open dirt, sand or gravel floor.

- c. If the re-occupancy standard ( $<0.010$  fibers per cubic centimeter Phase Contrast) is not met, the Contractor shall repeat final cleaning and continue decontamination procedures from that point. The Contractor shall be responsible for all costs incurred for additional air monitoring procedures, including labor and air sample analysis.
- d. If the release criteria is met, the Contractor shall remove the critical barriers separating the work area from the rest of the building and clean with amended water all areas where the barriers were attached. The air filtration units shall be shut down and sealed with polyethylene sheeting and tape to form a tight seal at the intake.

20.9 Where required, post-removal samples shall be taken and analyzed by Transmission Electron Microscopy (TEM), using the method outlined in 40 CFR 763.

- a. After the work area is clean, post-removal sampling shall be done in order to establish that conditions are safe for the removal of the critical barriers and the re-occupancy of the area. Sufficient time shall be allowed for the drying of the surfaces. All air filtration units shall be in operation during the monitoring.
- b. During the monitoring, normal occupancy conditions shall simulated using propeller fans or leaf blowers. Fans shall be placed in all areas to be sampled so as to cause settled fibers to rise and enter the air. All fans shall have fan blades with a radius of at least one foot and shall be capable of creating a minimum air velocity of 500 feet per minute and may be of the oscillating type. Sampling pumps and media shall be placed 20-40 feet at a right angle from the line(s) of air flow created in front of the fan. The leaf blower and its use must meet the criteria set forth in EPA Document 560/5-85-024, Guidance for Controlling Asbestos-Containing Materials in Buildings, appendix section M.1.5., or any replacement criteria set forth by the USEPA. Their use should be restricted to general occupancy areas, and they should not be used in any space with an open dirt, sand or gravel floor.
- c. If the re-occupancy standard is not met, the Contractor shall repeat final cleaning and continue decontamination procedures from that point. The Contractor shall be responsible for all costs incurred for additional air monitoring procedures, including labor and air sample analysis.
- d. If the release criteria is met, the Contractor shall remove the critical barriers separating the work area from the rest of the building and clean with amended water all areas where the barriers were attached. The air filtration units shall be shut down and sealed with polyethylene sheeting and tape to form a tight seal at the intake.

## **PART 21.0 - DISPOSAL OF ASBESTOS-CONTAINING WASTE**

- 21.1 The Contractor shall not allow asbestos materials to dry out or collect on the floors. Removed material shall be immediately placed in proper bags and sealed.
- 21.2 Each bag is to be sealed by twisting the open end and then tying an overhand knot in the twisted material or other approved technique which form a leak-tight seal. The bag shall then be placed in another bag, which is also sealed for transport to the disposal site. Broken or split bags shall be rebagged.
- 21.3 Warning labels, having waterproof print and permanent waterproof adhesive, shall be affixed to all bags, dumpsters, trucks and other containers used for asbestos. The labels shall be conspicuous and legible and shall contain the following warning (as a minimum):

DANGER  
Contains Asbestos Fibers  
May Cause Cancer  
Causes Damage to Lungs  
Do Not Breathe Dust  
Avoid Creating Dust

- 21.4 All waste bags shall also be labeled with the name and address of the Contractor and the generator of the waste.



- 21.5 All waste shall be placed in a waste container located outside of the building. The waste shall be transported to the container when the building is least occupied. The waste container shall be completely enclosed and locked and is to be only opened to put in materials from the removal area. Warning signs shall be placed on the waste container.
- 21.6 The Contractor shall transport all sealed bags to an approved sanitary landfill disposal site. Disposal shall be in accordance with all applicable Environmental Protection Agency and Department of Environmental Protection regulations.
- 21.7 The Contractor shall be responsible for obtaining approval of an asbestos waste disposal site in compliance with Section 61.25 of the EPA regulations and all other Federal, State and Local regulations. All transportation shall be performed by a registered waste hauler. The Contractor shall arrange with the transporter to obtain copies of receipts from the disposal site, indicating that the waste has been disposed of properly. The Contractor shall forward copies of these receipts to the Building Owner and their representatives.

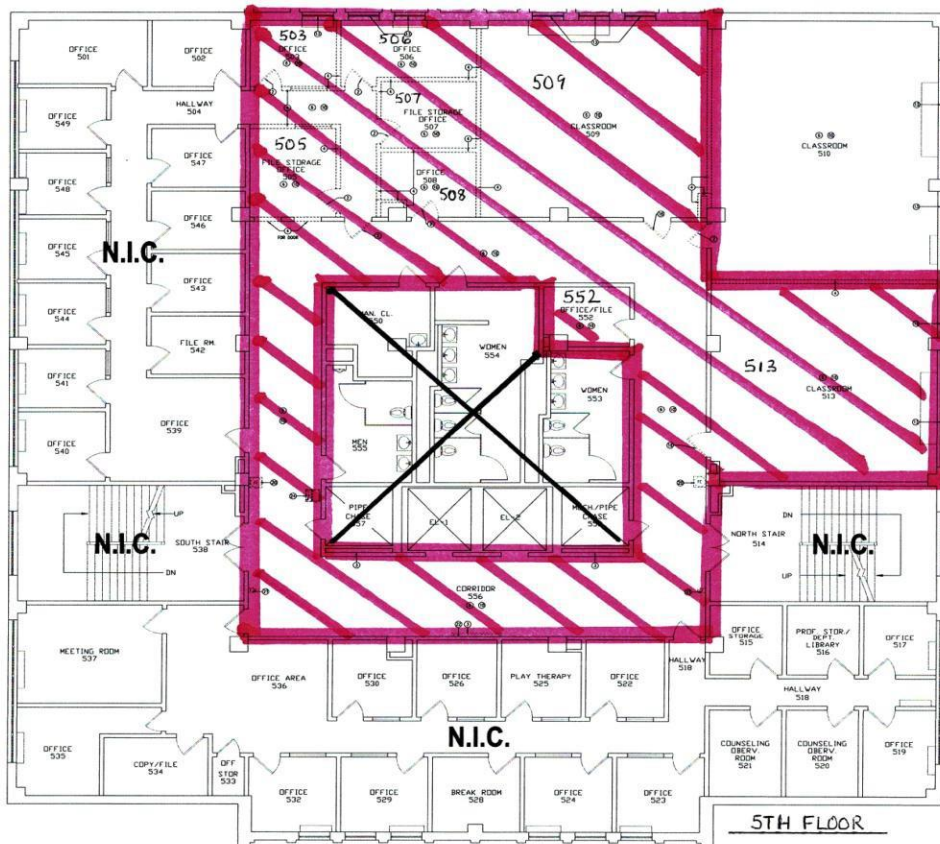
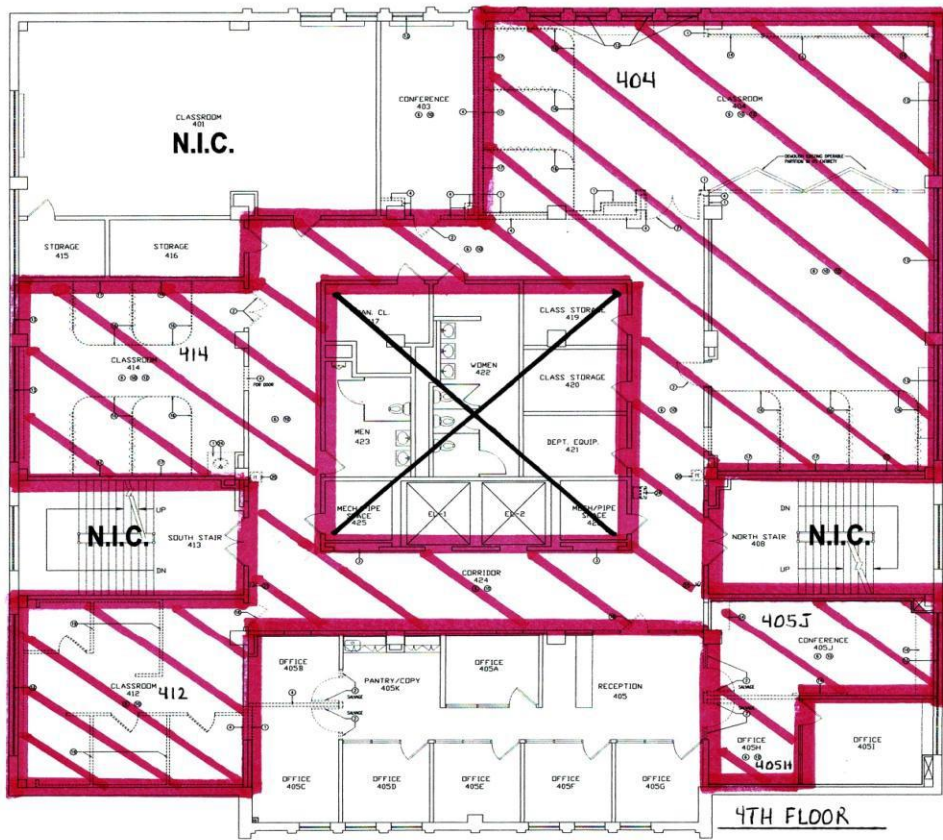
## **PART 22.0 - AIR MONITORING**

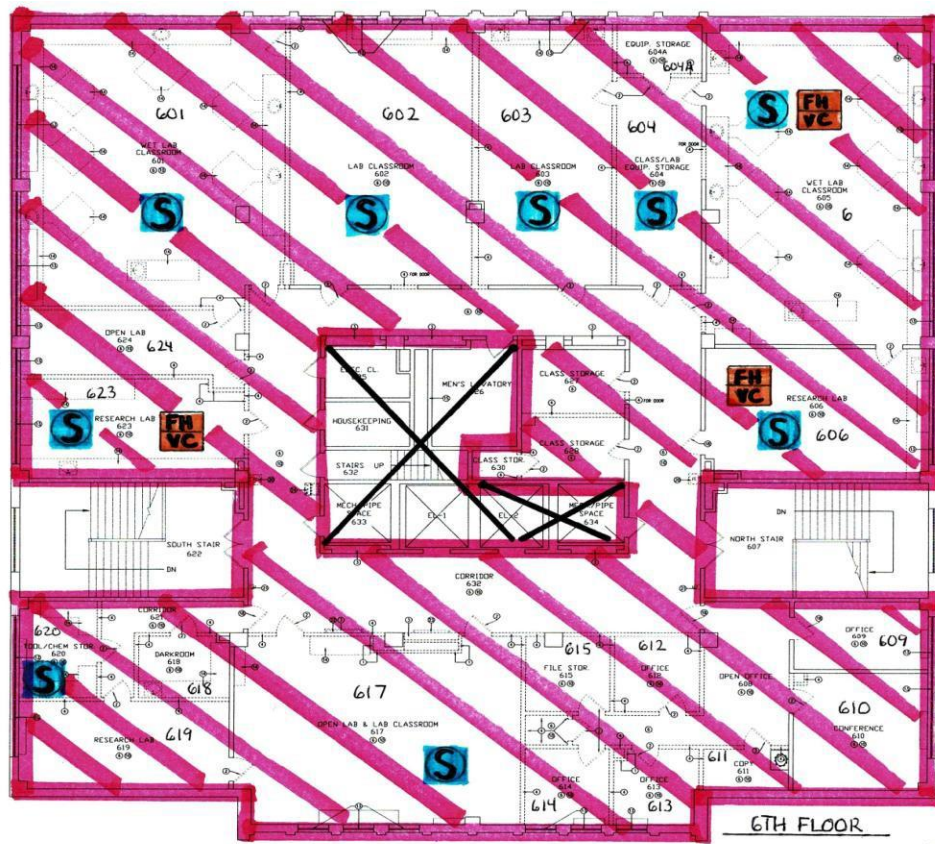
- 22.1 Where required, air monitoring on this project (except OSHA compliance monitoring) shall be performed by the safety monitor. The Abatement Contractor shall be responsible for providing daily OSHA compliance monitoring as per 29 CFR 1926.58 at no cost to the Building Owner. The Contractor shall fully cooperate with the safety monitor and all others responsible for testing and inspecting the jobsite.
- 22.2 None of the air tests collected by the Owner or their representatives are being collected for the purpose of meeting the Contractor's responsibilities under OSHA regulations, nor are they being conducted for the purpose of assessing the respiratory protection for the workers. It is the responsibility of the Contractor and their personnel to cooperate fully with the efforts of the Owner and their representatives at all times and ensure the ease of access to and from the work area for the effective completion of the monitoring work.
- 22.3 Any tampering with any equipment involved with the air testing or the ability of the air monitoring technician to perform any required duties shall be considered an attempt at falsifying reports and records to Federal and State agencies, and each offense shall be prosecuted under applicable State and Federal laws to the fullest extent possible.
- 22.4 No abatement work shall be initiated unless the Owner's representatives have been notified.
- 22.5 All abatement procedures may be stopped by the Environmental Project Managers if proper environmental, health and safety precautions are not strictly adhered to by the Contractor and their personnel. The Owner and their representative reserve the right to stop abatement operations and cancel the contract if proper environmental, health and safety precautions are not being strictly implemented and adhered to by the Contractor and their personnel.

## **PART 23.0 - INTENTIONALLY OMITTED**

## **PART 24.0 - COMPLETION OF ABATEMENT/CONTRACTOR'S FINAL DOCUMENTATION**

- 24.1 Upon completion of the work and meeting of the clearance criteria, the Contractor shall remove all equipment, materials and debris from the work site, dispose of all asbestos-containing waste material as specified and repair or replace all interior finishes damaged during the course of the asbestos abatement.
- 24.2 If any post-removal air tests or final inspections fail to meet the evaluation criteria, the Contractor shall be liable for the costs of additional air tests and technician labor.
- 24.3 The Contractor shall submit a report to the Owner upon completion of the removal project. The report shall contain all daily logs, operational data, a summary of all daily OSHA compliance test results, updated medical reports, proof that employees were notified if exposure levels exceeded current standards and documented proof that all asbestos materials have been disposed of in a legal, regulated landfill. No payments shall be made until all waste materials have been removed from the site and disposed of in a legal manner.
- 24.4 Request for payment may be withheld if all reports are not complete. The report shall be signed by an authorized representative of the Contractor.





### KEY



---- FLOOR COVERING REMOVAL AREA



---- SLATE TABLE/COUNTER TOP REMOVAL AREA



---- FUME HOOD/VIBRATION COLLAR REMOVAL AREA

SECTION 04 20 00  
UNIT MASONRY

PART 1 GENERAL

1.1 SUMMARY

- A. Patch existing interior concrete masonry unit construction following alteration work.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.
- C. Shop Drawings: Submit shop drawings for masonry, lintels and all accessories. Show sizes and shapes of units, supporting, anchoring restraint and reinforcing.
  - 1. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement." Show elevations of reinforced walls.
- D. Mix Designs: For each type of mortar and grout, include description of type and proportions of ingredients.
  - 1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.
  - 2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

1.3 QUALITY ASSURANCE

- A. Fire Performance for Fire-Rated Brick and Concrete Block Assemblies: ASTM E 119.
- B. Testing: Independent Testing Laboratory.
- C. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- D. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.
- E. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

- F. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

## PART 2 PRODUCTS

### 2.1 MATERIALS

- A. Concrete Masonry Units:
1. Application: Modifications of existing concrete masonry non-bearing partitions.
  2. Concrete Masonry Units: ASTM C 90, 1500 f'm compressive strength, normal weight.
  3. Size: Face dimension of 7-5/8 inches high by 15-5/8 inches long by width required for application.
  4. Special Finish: Standard aggregate, standard finish.
  5. Special Shapes: As required by building configuration.
  6. Bond Pattern: Running bond.
  7. Manufacturers: Subject to meeting the technical qualities specified, manufacturers of Concrete Masonry Units that will be considered include the following:
    - a. Basalite Concrete Products;
    - b. BASF Construction Chemicals;
    - c. Clayton Block;
    - d. or approved equal.
- B. Reinforcing Steel:
1. Reinforcing Bars: ASTM A 615, Grade 60.
  2. Deformed Reinforcing Wire: ASTM A 496.
  3. Welded Wire Fabric: ASTM A 185, plain.
- C. Reinforcing: Welded wire with deformed side rods.
1. Manufacturers:
  2. Steel Wire: 9 gauge (.1875 inch) galvanized steel.
  3. Type: Ladder or truss type.
- D. Ties and Anchors:
1. Manufacturers: Blok-Lok Ltd.; Heckmann Building Products, Inc.; Powers Fasteners; Wire-Bond; or approved equal.
  2. Bent Wire Ties: Galvanized steel.
  3. Rigid Anchors: Galvanized steel straps.
  4. Masonry to Steel Frame: Anchor with crimped wire anchor section for welding to steel.
  5. Adjustable Masonry Veneer Anchors: Screw-attached two-piece galvanized triangular or rectangular wire tie and metal anchor.
  6. Anchor Bolts: ASTM A 307, Grade A, galvanized.
  7. Post-installed Anchors: Chemical or expansion anchors.
- E. Mortar and Grout Materials
1. Portland Cement: ASTM C 150, Type I or II. Provide natural color or white cement as required to produce mortar color indicated.
  2. Hydrated Lime: ASTM C 207, Type S.
  3. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- A. Installation of Masonry Assemblies:
1. Comply with Portland Cement Association (PCA) Recommended Practices for Laying Concrete Block, Brick Institute of America BIA Tech Notes, and NCMA TEK Bulletins.
  2. Comply with manufacturers' written recommendations.
  3. Provide fire-rated assemblies complying with ASTM E 119.
  4. Sawcut units when required. Maintain uniform joint width. Provide full bed, head and collar joints except at weepholes.
  5. Install lintels and accessories in masonry construction.
  6. Coordinate installation of flashings.
  7. Comply with applicable codes and regulations for spacing of ties and horizontal reinforcing.
  8. Provide expansion and control joints in accordance with BIA and NCMA recommendations.
  9. Remove and replace damaged units.
  10. Clean brick using bucket and brush method, BIA Tech Note 20.
  11. Clean concrete masonry by dry brushing, NCMA TEK No. 28.
  12. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

### 3.2 REPAIRING, POINTING, AND CLEANING

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.
- B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

END OF SECTION

SECTION 05 50 00  
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following. Requirements for materials, hot-dip galvanizing, and shop-applied primers are included with each item as applicable.
  - a. Miscellaneous metal framing and supports not furnished as structural steel components.
  - b. Primed steel lintels for interior application.
  - c. Counter support brackets for built-in counters.
  - d. Miscellaneous metal framing and supports for mechanical and electrical equipment.
  - e. Other metal items indicated on the drawings but not specified elsewhere, and those metal items not indicated but required to complete the work.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design ladders and miscellaneous framing and supports, including comprehensive engineering analysis by a qualified professional engineer licensed in the state where the project is located, using performance requirements and design criteria indicated.

1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Nonslip aggregates and nonslip-aggregate surface finishes.
  - 2. Paint products.
  - 3. Grout.
- B. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  - 2. Provide templates for anchors and bolts specified for installation under other Sections.
  - 3. Where fabrications are to receive sprayed-on fireproofing, include statement that primer is compatible with fireproofing proposed for use.
- C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation and licensed in the state where the project is located.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.



#### 1.4 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the 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 metal fabrications that are similar to those indicated for this Project in material, design, and extent.
- C. Welding: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1, "Structural Welding Code--Steel."
  - 2. AWS D1.3, "Structural Welding Code--Sheet Steel."
- D. 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.

#### 1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

#### 1.6 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.
- B. Coordinate installation of anchorages for metal fabrications. 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.
- C. Coordinate installation of metal fabrications, such as steel weld plates and angles for casting into concrete, that are specified in this Section but required for work of another Section. Deliver such items to Project site to not delay their installation.

### PART 2 - PRODUCTS

#### 2.1 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.

- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
  - 1. Provide Schedule 80 pipe for bollards.
- D. Slotted Channel Framing: Cold-formed metal channels with continuous slot complying with MFMA-4.
- E. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

## 2.2 FASTENERS

- A. General: Unless otherwise indicated, provide Type 316 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, in exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Anchor Bolts: ASTM F 1554, Grade 36. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- C. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- D. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Acceptable Manufacturers: Kwik-Bolt 3 by Hilti, Inc., TruBolt Wedge Anchor by ITW Red Head or Power-Stud by Powers Fasteners.
- 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.

## 2.3 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.

- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

#### 2.4 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 true to line and level 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 where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be 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.

#### 2.5 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.

- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Fabricate units from slotted channel framing where indicated.
  - 2. Furnish inserts if units are installed after concrete is placed.

## 2.7 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
  - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.

## 2.8 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.9 STEEL PRIMERS AND FINISHES

- A. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  - 1. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush Off Blast Cleaning."
  - 2. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be field welded, or embedded in concrete or masonry, unless otherwise indicated. Extend priming of partially embedded members to a depth of 2 inches.
  - 3. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
  - 4. Comply with SSPC-PA 2, "Measurement of Dry Coating Thickness with magnetic Gages."
- B. Apply shop primer to uncoated surfaces of metal components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply

with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended 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 bolts, 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.
- F. Corrosion Protection: Coat concealed surfaces of steel that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of isolation coating.

#### 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: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Touch-Up and Repair for Galvanized Surfaces: For damaged and field-welded metal coated surfaces, clean welds, bolted connections and abraded areas.
  - 1. For galvanized surfaces, apply organic zinc repair paint complying with requirements of ASTM A 780, modified to 95 percent zinc in dry film. Galvanizing repair paint shall have

- 95 percent zinc by weight, ZiRP by Duncan Galvanizing. Thickness of applied galvanizing repair paint shall be not less than coating thickness required by ASTM A 123 or A 153 as applicable. Touch-up of galvanized surfaces with silver paint, brite paint, or aluminum paints is not acceptable.
2. For factory-applied finish coatings, field-touch-up shall be performed by factory approved personnel. Touch-up shall be such that repair is not visible from a distance of 6 feet.
  3. A touch-up repair kit or touchup instructions shall be provided to the Owner for each type of factory-applied finish.

END OF SECTION

SECTION 06 10 00  
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SUMMARY

- A. Provide rough carpentry as follows:
  - 1. Wood blocking and nailers built into interior partitions and ceiling assemblies to support other work.
  - 2. Plywood backing panels.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Lumber Standards and Grade Stamps: DOC PS 20, American Softwood Lumber Standard and inspection agency grade stamps.
- C. Construction Panel Standards: DOC PS 1, U.S. Product Standard for Construction and Industrial Plywood; APA PRP-108.
- D. Preservative Treatment: AWPA C2 for lumber and AWPA C9 for plywood; waterborne pressure treatment. Provide for wood in contact with soil, concrete, masonry, roofing, flashing, dampproofing and waterproofing.
- E. Fire-Retardant Treatment: AWPA C20 for lumber and AWPA C27 for plywood; noncorrosive type. Provide at building interior.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Rough Carpentry:
  - 1. Miscellaneous Lumber:
    - a. Moisture Content: 19 percent.
    - b. Grade: Standard grade light framing.
  - 2. Construction Panels:
    - a. Telephone, security and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated.
  - 3. Anchors and Fasteners:
    - a. Material: Non-corrosive, suitable for load and exposure. Drywall screws are not acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated,
- B. Provide nailers, blocking and grounds where required. Set work plumb, level and accurately cut.
- C. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction. Coordinate with other work.
- D. Comply with manufacturer's requirements for cutting, handling, fastening and working treated materials.
- E. Restore damaged components. Protect work from damage.

END OF SECTION



SECTION 06 40 23  
INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Interior standing and running trim.
  - 2. Wood veneer casework.
  - 3. Plastic laminate casework.
  - 4. Plastic laminate plumbing enclosure skirts below solid surface countertops.
  - 5. Plastic laminate recycling station with solid surface top.
  - 6. Plastic laminate adjustable wall shelving.
  - 7. Shop finishing of interior woodwork.

1.2 COORDINATION

- A. Coordinate with Section 05 50 00 - METAL FABRICATIONS for steel countertop support requirements.

1.3 SUBMITTALS

- A. Product Data: For each type of product specified, including casework hardware and accessories, and finishing materials and processes.
  - 1. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- 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.
    - a. Provide schedule or shop drawings of blocking required to support the Work of this Section.
  - 2. Show locations and sizes of cutouts and holes for plumbing fixtures, electrical components and other items installed in architectural woodwork.
  - 3. Show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.
- C. Samples for Verification:
  - 1. Lumber with or for transparent finish, not less than 5 inches wide by 12 inches long for each species and cut, finished on 1 side and 1 edge.
  - 2. Veneer leaves representative of and selected from flitches to be used for transparent-finished woodwork.
    - a. Submit step-type range sample sets of factory finished plywood and factory finished solid wood in size illustrating wood grain and specified finish, including edge banding detail and any veneer or solid edge glue joints.
    - b. Submit one leaf for every 1000 gross square foot of veneer required.
  - 3. Plastic laminates, 8 by 10 inches for each type, color, pattern, and surface finish, with 1 sample applied to core material, and specified edge material applied to 1 edge.
  - 4. Solid-surfacing materials, 6 inches square for each color, including each type of edge treatment.

- D. Woodwork Quality Standard Compliance Certificates: Submit registration number for AWI Quality Certification Program.
- E. Qualification Data: For Installer and fabricator.

#### 1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- B. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production of interior architectural woodwork with blueprint-matched wood veneers and components.
- C. Quality Standard: Unless otherwise indicated, comply with AWI/AWMAC/WI's "Architectural Woodwork Standards," latest edition, including errata, for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.
- D. Fire-Test-Response Characteristics: Where fire-retardant materials or products are indicated, provide materials and products with specified fire-test-response characteristics as determined by testing identical products per test method indicated by UL, ITS, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.
- E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. General: Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

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

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork 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.
  - 1. The HVAC systems as specified elsewhere will not provide for humidity controls. The building will be air conditioned in summer months. The ranges of relative humidity are expected to be as high as 70% to an uncontrolled low during the heating season. Comply with AWS Section 2, Care and Storage.

2. Contractor shall assume full responsibility for fabricating interior architectural woodwork to not deteriorate in the interior environment expected during occupancy, which is standard for the majority of new buildings designed and constructed .
  - a. Submission of bid shall represent acceptance of these terms.
  - b. Contrary manufacturer's and AWI disclaimers shall not apply if more restrictive than the conditions stated herein, as more stringent conditions are not typically provided in academic buildings.
  
- B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed, and indicate measurements on Shop Drawings.
  2. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming and scribing 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 interior architectural woodwork can be supported and installed as indicated, and can accommodate plumbing and electrical provisions.
  
- B. Coordinate stain color of transparent wood finish so that casework finish matches wood door finish.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of AWI/AWMAC/WI's "Architectural Woodwork Standards" for each type of woodwork and quality grade specified, unless otherwise indicated.
  
- B. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with an average recycled content so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
  
- C. Wood Veneers and Lumber: Provide AWI Custom Grade materials and workmanship. For species not listed in the AWS comply with the following:
  1. Provide AWI Lumber Grade 1 and AWI Grade A Veneer, book-matched, minimum 6 inch face veneer width. Kiln dry to 6-8 percent moisture content. Components shall be free of defects and sapwood. Match adjacent pieces for color and grain pattern.
  2. Single-Source Requirement for Wood Veneers and Solids: Intent is to provide wood which matches as closely as possible throughout the project. Provide wood veneers and solids from the same distributor, and from the same flitches and solids sources to the greatest extent possible.
  
- D. Wood Species and Cut for Transparent Finish:
  1. Select white maple, plain sawn.
  2. Veneer Grade: A.

3. Matching Between Adjacent Veneer Leaves: Book match and architectural end match.
  4. Matching Within Individual Panel Faces: Balance and Center Match.
  5. Method of Matching Panels: Blueprint-matched panels and components.
- E. Wood Core Products: Comply with the following:
1. Recycled Content of Medium-Density Fiberboard and Particleboard: Provide products with recycled content.
  2. Hardboard: AHA A135.4.
  3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade MD, made with binder containing no added urea formaldehyde.
  4. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
  5. Softwood Plywood: DOC PS 1, Medium Density Overlay (MDO).
  6. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no added urea formaldehyde.
    - a. Resin impregnated paper backs are not permitted. Backs shall be of compatible hardwood species and cut. Contact adhesive is not permitted.
    - b. Provide finished back and side panels where exposed to view in the final assembly
    - c. Provide removable back panels in cabinets receiving plumbing or electrical utilities.
- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or, if not indicated, as required by woodwork quality standard.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated into the Work include, but are not limited to, the following:
    - a. Abet Laminati, Inc.
    - b. Arborite; Division of ITW Canada, Inc.
    - c. Formica Corporation.
    - d. Lamin-Art, Inc.
    - e. Nevamar Company; a division of Panolam Industries.
    - f. Wilsonart International; Div. of Premark International, Inc.
- G. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS-1 and ISSFA-2.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Avonite, Inc.
    - b. E. I. du Pont de Nemours and Company; Corian.
    - c. Formica Corporation.
    - d. LG Chemical, Ltd.
    - e. Nevamar Company, LLC; Decorative Products Div.
    - f. Swanstone, The Swan Corporation
    - g. Wilsonart International; Div. of Premark International, Inc.
- ## 2.2 FIRE-RETARDANT-TREATED MATERIALS
- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this Article, which are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified.
1. Do not use treated materials that do not comply with requirements of referenced woodworking standard or that are warped, discolored, or otherwise defective.

2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
  3. Identify fire-retardant-treated materials with appropriate classification marking of UL, U.S. Testing, Timber Products Inspection, or another testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Comply with performance requirements of AWPA C20 (lumber) and AWPA C27 (plywood). Use the following treatment type:
1. Exterior Type: Organic-resin-based formulation thermally set in wood by kiln drying.
  2. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
  3. Kiln-dry materials before and after treatment to levels required for untreated materials.
- C. Fire-Retardant Particleboard: Panels complying with the following requirements, made from softwood particles and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 25 or less per ASTM E 84.
1. Fire-Retardant Fiberboard and Particleboard: Provide five ply construction with crossbands to prevent any ammonia fuming from the core to the face veneers.

### 2.3 CASEWORK HARDWARE AND ACCESSORIES

- A. General: Provide casework hardware and accessory materials associated with architectural casework as selected by architect, except for items specified in Section 08 71 00 - DOOR HARDWARE.
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 160 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Catches: Push-in magnetic catches, BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports:
1. Casework: BHMA A156.9, B04071; with shelf rests, B04081.
  2. Wall Shelving: KV 87 Series, heavy-duty, with heavy-duty brackets, or comparable product as approved by Architect.
- F. Drawer Slides: BHMA A156.9, B05091; side mounted and extending under bottom edge of drawer; full-extension type; epoxy-coated-steel with steel ball-bearings; of the following grades:
1. Box Drawer Slides: Grade 1.
  2. File Drawer Slides: Grade 1HD-100.
  3. Pencil Drawer Slides: Grade 2.
  4. Keyboard Slides: Grade 1.
  5. Trash Bin Slides: Grade 1HD-100.
- G. Concealed Undermount Drawer Slide: Hafele 421.23.840, or comparable product, as approved by Architect.
1. Provide in locations where indicated; 2 per drawer.

- 2. Size: As required by installed condition.
- H. Door Locks: BHMA A156.11, E07121.
- I. Drawer Locks: BHMA A156.11, E07041.
- J. Grommets for Cable Passage through Countertops: Molded-plastic grommets and matching plastic caps with slot for wire passage.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
  - 1. Satin Stainless Steel: BHMA 630.
  - 2. Satin Aluminum, Clear Anodized: BHMA 628.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

#### 2.4 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.
- C. Adhesives, General: Do not use adhesives that contain urea formaldehyde.
- D. VOC Content: Provide interior, field applied adhesives and sealants that comply with the VOC limits outlined in Section 01 81 13 – Sustainable Design Requirements.

#### 2.5 FABRICATION, GENERAL

- A. Wood Moisture Content: Comply with requirements specified herein and supplemented by referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- B. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Corners of Casework and Edges of Solid-Wood (Lumber) Member: 1/16 inch.
- D. Complete fabrication, including assembly, finishing, 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.
- E. Shop-cut openings to maximum extent possible to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or

roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

1. Seal edges of openings in countertops with a coat of varnish.

## 2.6 INTERIOR STANDING AND RUNNING TRIM FOR OPAQUE FINISH

- A. Grade: Custom.
- B. Wood Species: Any closed-grain hardwood.
- C. Backout or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
- D. Assemble casings in plant except where limitations of access to place of installation require field assembly.

## 2.7 WOOD CASEWORK FOR TRANSPARENT FINISH

- A. Grade: Custom.
- B. AWI Type of Casework Construction: Flush overlay.
- C. Wood Species and Cut for Exposed Surfaces: As specified hereinabove.
  1. Grain Direction: Vertically for drawer fronts, doors, and fixed panels.
  2. Matching of Veneer Leaves: Book match.
  3. Vertical Matching of Veneer Leaves: End match.
  4. Veneer Matching within Panel Face: Running match.
  5. Veneer Matching within Room: Provide casework veneers in each room or other space from a single flitch with doors, drawer fronts, and other surfaces matched in a sequenced set with continuous match where veneers are interrupted perpendicular to the grain.
- D. Semiexposed Surfaces: Provide surface materials indicated below:
  1. Surfaces Other Than Drawer Bodies: Compatible species to that indicated for exposed surfaces, stained to match.
  2. Drawer Sides and Backs: Solid-hardwood lumber, stained to match species indicated for exposed surfaces.
  3. Drawer Bottoms: Hardwood plywood.

## 2.8 PLASTIC-LAMINATE CASEWORK

- A. Grade: Custom.
- B. AWI Type of Casework Construction: Flush overlay.
- C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
  1. Horizontal Surfaces Other Than Tops: Grade HGS.
  2. Vertical Surfaces: Grade HGS.
  3. Edges: Grade HGS.
- D. Materials for Semiexposed Surfaces:
  1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.

- a. Edges of Plastic-Laminate Shelves: PVC tape, 0.018-inch minimum thickness, matching laminate in color, pattern, and finish high-pressure laminated.
- b. For semiexposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, Grade VGS.
- 2. Drawer Sides and Backs: Solid-hardwood lumber.
- 3. Drawer Bottoms: Hardwood plywood.
- E. Concealed Backs of Panels with Exposed Plastic Laminate Surfaces: High-pressure decorative laminate, Grade BKL.
- F. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. As selected by Architect from laminate manufacturer's full range.

## 2.9 PLASTIC-LAMINATE COUNTERTOPS

- A. Grade: Custom.
- B. High-Pressure Decorative Laminate Grade: HGS.
- C. 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 selected by Architect from manufacturer's full range.
- D. Edge Treatment: As indicated.
- E. Core Material: Exterior-grade plywood.
- F. Backer Sheet: Provide plastic-laminate backer sheet, Grade BKL, on underside of countertop substrate.

## 2.10 SOLID-SURFACING-MATERIAL COUNTERTOPS AND WINDOW STOOLS

- A. Grade: Custom.
- B. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
  - 1. As selected by Architect from manufacturer's full range.
- C. Fabricate in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate with shop-applied edges of materials and configuration indicated.
  - 2. Fabricate countertops with loose backsplashes for field application.
- D. Drill holes in countertops for plumbing fittings and soap dispensers in shop.

## 2.11 WOOD VENEER SHELVING

- A. Grade: Custom.
- B. Shelf Material: 1-inch plywood core with high-pressure polyresin edge.
- C. Standards for Adjustable Shelf Brackets: BHMA A156.9, B04102; powder-coat-finished steel.



- D. Adjustable Shelf Brackets: BHMA A156.9, B04112; powder-coat-finished steel.

## 2.12 SHOP FINISHING

- A. General: Comply with AWI/AWMAC/WI's "Architectural Woodwork Standards" for factory finishing.
  - 1. Finish architectural woodwork at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.
- B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.
  - 1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling and to end-grain surfaces. Concealed surfaces of plastic-laminate-clad woodwork do not require backpriming when surfaced with plastic laminate or thermoset decorative panels.
- C. Transparent Finish: Comply with requirements indicated below for grade, finish system, staining, and sheen with sheen measured on 60-degree gloss meter per ASTM D 523:
  - 1. Grade: Same as item to be finished.
  - 2. AWS Finish System 5: Water white conversion varnish.
  - 3. Staining: Match approved sample for color.
  - 4. Wash Coat for Stained Finish: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
  - 5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
  - 6. Sheen: Satin, 30-50 gloss units.
  - 7. Effect: Partially filled pore.
- D. Opaque Finish: Comply with requirements indicated below for grade, finish system, color, effect, and sheen, with sheen measured on 60-degree gloss meter per ASTM D 523.
  - 1. Grade: Same as item to be finished.
  - 2. AWS Finish System 5: Conversion varnish.
  - 3. Color: As selected by Architect from manufacturer's full range.
  - 4. Sheen: Satin, 30-50 gloss units.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

### 3.2 INSTALLATION

- A. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- B. Assemble woodwork and complete fabrication at Project site to comply with requirements for fabrication in Part 2, to extent that it was not completed in the shop.

- C. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.
  - D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
  - E. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with chemical treatment manufacturer's written instructions, including those for adhesives used to install woodwork.
  - F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
  - G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 60 inches long, except where shorter single-length pieces are necessary. Scarf running joints and stagger in adjacent and related members.
    - 1. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.
    - 2. Install wall railings on indicated metal brackets securely fastened to wall framing.
    - 3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.
  - H. Casework: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
    - 1. Install casework with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
    - 2. Maintain veneer sequence matching of casework with transparent finish.
  - I. Countertops: Anchor securely by screwing through corner blocks of base casework or other supports into underside of countertop.
    - 1. Align adjacent solid-surfacing-material countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
    - 2. Install countertops with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
    - 3. Secure backsplashes to tops with concealed metal brackets at 16 inches and to walls with adhesive.
    - 4. Caulk space between backsplash and wall with sealant specified in Section 07 92 00 - JOINT SEALANTS.
  - J. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.
- 3.3 ADJUSTING AND CLEANING
- A. Repair damaged and defective woodwork, 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 woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

**SECTION 07 84 00 - PENETRATION FIRESTOPPING  
PART 1 - GENERAL**

**1.1 SUMMARY**

A. This Section includes the following:

1. Through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.

**1.2 PERFORMANCE REQUIREMENTS**

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are 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.

1. Fire-resistance-rated walls including fire walls, fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814 or UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:
  - a. Penetrations located outside wall cavities.
  - b. Penetrations located outside fire-resistance-rated shaft enclosures.
3. L-Rated Systems: Where through-penetration firestop systems are indicated in smoke barriers, provide through-penetration firestop systems with L-ratings indicated at both ambient temperatures and 400 deg F.

C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
  3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

### 1.3 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. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping condition, submit illustration, with modifications marked, approved by penetration firestopping manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.
- C. Qualification Data: For qualified Installer.
- D. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for penetration firestopping.

### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing through-penetration firestop systems similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful performance.
- B. Source Limitations: Obtain through-penetration firestop systems, for each kind of penetration and construction condition indicated, through one source from a single manufacturer.
- C. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
  1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, or another agency performing testing

and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.

2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
  - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
  - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:
    - 1) UL in its "Fire Resistance Directory."
    - 2) OPL in its "Directory of Listed Building Products, Materials, & Assemblies."
    - 3) ITS in its "Directory of Listed Products."

D. Preinstallation Conference: Conduct conference at Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

#### 1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.

- C. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- D. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's inspecting agency and building inspector, if required by authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers:
  - 1. Grace, W. R. & Co. - Conn.
  - 2. Hilti, Inc.
  - 3. Johns Manville.
  - 4. 3M; Fire Protection Products Division.
  - 5. Tremco; Sealant/Weatherproofing Division.
  - 6. USG Corporation.
  - 7. Approved equal.

### 2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
  - 1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-/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. Collars.
- 3. Impaling clips.

4. Support angles and thread rods.

2.3 FILL MATERIALS

- A. General: Provide through-penetration firestop systems containing the types of fill materials indicated in the Through-Penetration Firestop System Schedule at the end of Part 3 by referencing the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a non-shrinking, homogeneous mortar.
- I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- J. Silicone Foams: Multi-component, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam.
- K. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below:
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces, and non-sag formulation for openings in vertical and other surfaces requiring a non-slumping, gunnable sealant, unless indicated firestop system limits use to non-sag grade for both opening conditions.



2. Grade for Horizontal Surfaces: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces.
3. Grade for Vertical Surfaces: Non-sag formulation for openings in vertical and other surfaces.
- L. Firesafing Insulation: Refer to Division 7 Section "Building Insulation" for products and requirements.

## 2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system 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 work.
  1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system 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 through-penetration firestop systems.
  2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. 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 through-penetration firestop system 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 through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

### 3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing 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 firestop systems.
- C. Install fill materials for firestop systems 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 Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

### 3.4 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestops. Independent inspecting agency shall comply with ASTM E 2174 and Building Code requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

### 3.5 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system 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 through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

### 3.6 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. Where UL-classified systems are indicated, they refer to alpha-alpha-numeric designations listed in UL's "Fire Resistance Directory" under product Category XHEZ.
- B. Where OPL-classified systems are indicated, they refer to alpha-numeric design numbers in OPL's "Directory of Listed Building Products, Materials, & Assemblies."
- C. Where ITS-listed systems are indicated, they refer to design numbers listed in ITS's "Directory of Listed Products," "Firestop Systems" Section.

- D. Firestop Systems with No Penetrating Items:

- 1. UL-Classified Systems: As indicated.
- 2. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Mortar.

- E. Firestop Systems for Metallic Pipes, Conduit, or Tubing:

- 1. UL-Classified Systems: As indicated.
- 2. Type of Fill Materials: One or more of the following:
  - a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Mortar.

- F. Firestop Systems for Nonmetallic Pipe, Conduit, or Tubing:

- 1. UL-Classified Systems: As indicated.
- 2. Type of Fill Materials: One or more of the following:

- a. Latex sealant.
  - b. Silicone sealant.
  - c. Intumescent putty.
  - d. Intumescent wrap strips.
  - e. Firestop device.
- G. Firestop Systems for Electrical Cables:
1. UL-Classified Systems: As indicated.
  2. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Silicone sealant.
    - c. Intumescent putty.
    - d. Silicone foam.
    - e. Pillows/bags.
- H. Firestop Systems for Cable Trays:
1. UL-Classified Systems: As indicated.
  2. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Intumescent putty.
    - c. Silicone foam.
    - d. Pillows/bags.
    - e. Mortar.
- I. Firestop Systems for Insulated Pipes:
1. UL-Classified Systems: As indicated.
  2. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Intumescent putty.
    - c. Silicone foam.
    - d. Intumescent wrap strips.
- J. Firestop Systems for Miscellaneous Electrical Penetrants:
1. UL-Classified Systems: As indicated.
  2. Type of Fill Materials: One or more of the following:
    - a. Latex sealant.
    - b. Intumescent putty.

- c. Mortar.
  
  - K. Firestop Systems for Miscellaneous Mechanical Penetrants:
    - 1. UL-Classified Systems: As indicated.
  
    - 2. Type of Fill Materials: One or both of the following:
      - a. Latex sealant.
      - b. Mortar.
  
  - L. Firestop Systems for Groupings of Penetrants:
    - 1. UL-Classified Systems: As indicated.
    - 2. Type of Fill Materials: One or more of the following:
      - a. Latex sealant.
      - b. Mortar.
      - c. Intumescent wrap strips.
      - d. Firestop device.
      - e. Intumescent composite sheet.
- END OF SECTION

## SECTION 07 92 00 - 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. Urethane joint sealants.
- B. Related Sections:
  - 1. Division 04 Section "Unit Masonry"
  - 2. Division 08 Section "Glazing"

#### 1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- D. Qualification Data complying with requirements specified in Quality Assurance article. Include list of completed projects with project names, addresses, names of Architects and Owners, plus other information specified.
- E. Product Certificates: For each kind of joint sealant and accessory, from manufacturer, attesting that their products comply with specification requirements and are suitable for the use indicated.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.
- B. Engage an experienced installer who has completed joint sealant applications similar in material, design and extent to that indicated for project that have resulted in construction with record of successful in-service performance.

## 1.5 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. **Compatibility:** Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.
- B. **Liquid-Applied Joint Sealants:** Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
- C. **Suitability for Contact with Food:** Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.
- D. **Colors of Exposed Joint Sealants:** As selected by Architect from manufacturer's full range.

### 2.2 URETHANE JOINT SEALANTS

- A. **Single-Component, Nonsag, Urethane Joint Sealant:** ASTM C 920, Type S, Grade NS, Class 25, for 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. BASF Building Systems.
    - b. Bostik, Inc.; Chem-Calk.
    - c. May National Associates, Inc.
    - d. Pacific Polymers International, Inc.
    - e. Pecora Corporation.
    - f. Polymeric Systems, Inc..
    - g. Schnee-Morehead, Inc..
    - h. Sika Corporation, Construction Products Division.
    - i. Tremco Incorporated.

## 2.3 JOINT SEALANT BACKING

- A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.
- B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin) [Type O (open-cell material), Type B (bicellular material with a surface skin), or any of the preceding types, as approved in writing by joint-sealant manufacturer for joint application indicated, and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.
- C. 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.

## 2.4 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
  - 1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.



2. Clean porous joint substrate surfaces by brushing, grinding, 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. 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.

- 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 flush joint profile where indicated per Figure 8B in ASTM C 1193.

#### 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 joint sealants and of products in which joints occur.

#### 3.5 PROTECTION

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

END OF SECTION 07 92 00

SECTION 08 11 10  
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Standard hollow-metal steel doors.
  - 2. Standard hollow-metal steel frames.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, temperature-rise ratings, and finishes for each type of steel door and frame specified.
- B. Shop Drawings:
  - 1. Elevations of each door design.
  - 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of each different wall opening condition.
  - 6. Details of anchorages, joints, field splices, and connections.
  - 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 door hardware schedule.
- D. Qualification Data: For Installer.
- E. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of standard steel door and frame.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain standard steel doors and frames through one source from a single manufacturer.
- C. Fire-Rated Door, Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings 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.

- D. Fire-Rated, Borrowed-Light Assemblies (Including Sidelights and Transoms): 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.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletized, wrapped, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch-high wood blocking. Do not store in a manner that traps excess humidity.
  - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

#### 1.5 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

#### 1.6 COORDINATION

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

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Ceco Door Products; an ASSA ABLOY Group Company.
  - 2. CURRIES Company; an ASSA ABLOY Group Company.
  - 3. de LaFontaine
  - 4. Mesker Door Inc.
  - 5. Pioneer Industries, Inc.
  - 6. Philipp Manufacturing Company.
  - 7. Republic Builders Products Company.
  - 8. Steelcraft; an Ingersoll-Rand company.

#### 2.2 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.
- E. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
  - 1. 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.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Powder-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches, as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool with 6- to 12-lb/cu. ft. density; with maximum flame-spread and smoke-development indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
- J. Glazing: Comply with requirements in Section 08 80 00 - GLAZING.
- K. Isolation Coating: ASTM D 1187, cold-applied asphalt emulsion, compounded for 15-mil dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

## 2.3 STANDARD STEEL DOORS

- A. General: Provide doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces, unless otherwise indicated. Comply with ANSI A250.8.
  - 1. Design: Flush panel.
  - 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, polystyrene, polyurethane, mineral-board, or vertical steel-stiffener core that produces doors complying with ANSI A250.8.
    - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
    - b. Thermal-Rated (Insulated) Exterior Doors: Where indicated, provide doors fabricated with thermal-resistance value (R-value) of not less than 4.0 deg F x h x sq. ft./Btu when tested according to ASTM C 1363.
  - 3. Top and Bottom Edges: Closed with flush or inverted 0.042-inch-thick end closures or channels of same material as face sheets.

4. Tolerances: Comply with SDI 117, "Manufacturing Tolerances for Standard Steel Doors and Frames."
- B. Exterior Doors: Face sheets fabricated from metallic-coated steel sheet. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
  1. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
  2. Exterior doors shall be not less than 16 gauge steel.
  3. The top channel of each metal door shall be solid without pockets which collect dirt and water.
  4. All exterior doors and frames shall be galvanized.
- C. Interior Doors: Face sheets fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior door requirements. Provide doors complying with requirements indicated below by referencing ANSI A250.8 for level and model and ANSI A250.4 for physical-endurance level:
  1. Level 2 and Physical Performance Level B (Heavy Duty), Model 2 (Seamless), 1-3/4 inches thick.
  2. Interior doors shall be not less than 18 gauge steel.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- E. Fabricate concealed stiffeners and hardware reinforcement from either cold- or hot-rolled steel sheet.

## 2.4 STANDARD STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile. All door frames shall be 16 gauge. Knock-down frames are prohibited unless specifically approved in writing by Office of Facilities Design.
- B. Exterior Frames: Fabricated from metallic-coated steel sheet.
  1. Fabricate frames with full profile welded joints.
  2. Frames for Level 3 Steel Doors: 0.067-inch-thick steel sheet.
- C. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
  1. Fabricate frames with full profile welded joints.
  2. Frames for Level 2 Steel Doors: 0.053-inch-thick steel sheet.
- D. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.

## 2.5 FRAME ANCHORS

- A. Jamb Anchors:
  1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
  2. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch thick.

3. Compression Type for Drywall Slip-on Frames: Adjustable compression anchors.
  4. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch-diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
- B. Floor Anchors: Formed from same material as frames, not less than 0.042 inch (1.0 mm) thick, and as follows:
1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.
  2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at finish floor surface.
- 2.6 HOLLOW METAL PANELS
- A. Provide hollow metal panels of same materials, construction, and finish as specified for adjoining hollow metal work.
- 2.7 STOPS AND MOLDINGS
- A. Moldings for Glazed Lites in Doors: Minimum 0.032 inch thick, fabricated from same material as door face sheet in which they are installed.
- B. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated.
- C. Loose Stops for Glazed Lites in Frames: Minimum 0.032 inch thick, fabricated from same material as frames in which they are installed.
- 2.8 ACCESSORIES
- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Ceiling Struts: Minimum 1/4-inch-thick by 1-inch-wide steel.
- C. Grout Guards: Formed from same material as frames, not less than 0.016 inch thick.
- 2.9 FABRICATION
- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- C. Hollow Metal Doors:
1. Exterior Doors: Provide weep-hole openings in bottom of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
  2. Glazed Lites: Factory cut openings in doors.
  3. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

- D. 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. Full Profile Welded Frames: Weld joints continuously; grind, fill, dress, and make smooth, flush, and not visible.
  2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as doorframe. Fasten members at crossings and to jambs by butt welding.
  3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  4. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  5. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
  6. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Two anchors per jamb up to 60 inches high.
      - 2) Three anchors per jamb from 60 to 90 inches high.
      - 3) Four anchors per jamb from 90 to 120 inches high.
      - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
    - b. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
      - 1) Three anchors per jamb up to 60 inches high.
      - 2) Four anchors per jamb from 60 to 90 inches high.
      - 3) Five anchors per jamb from 90 to 96 inches high.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
      - 5) Two anchors per head for frames above 42 inches wide and mounted in metal-stud partitions.
    - c. Compression Type: Not less than two anchors in each jamb.
    - d. Postinstalled Expansion Type: Locate anchors not more than 6 inches from top and bottom of frame. Space anchors not more than 26 inches o.c.
  7. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    - b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
- E. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from either cold- or hot-rolled steel sheet.
- F. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Section 08 71 00 - DOOR HARDWARE.
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8 and ADA standards.
  2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
  3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.



4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 - ELECTRICAL.
- G. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or 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 type of glazing and type of installation indicated.
- 2.10 STEEL FINISHES
- A. Prime Finish: Apply manufacturer's standard epoxy primer immediately after cleaning and pretreating.
1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
  2. Refer to Section 09 90 00 – PAINTING for field-applied coating.

### 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. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for squareness, alignment, twist, and plumbness to the following tolerances:
  1. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
  2. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
  3. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
  4. Plumbness: Plus or minus 1/16 inch, measured at jambs on a perpendicular line from head to floor.

- C. 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 of size and profile indicated. Comply with ANSI/SDI A250.11.
  - 1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-protection-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 glazing stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply isolation coating to backs of frames that are filled with grout.
  - 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 powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  - 3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
  - 4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  - 5. Concrete Walls: Solidly fill space between frames and concrete with grout. Take precautions, including bracing frames, to ensure that frames are not deformed or damaged by grout forces.
  - 6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 7. In-Place Gypsum Board Partitions: Secure frames in place with postinstalled expansion anchors through floor anchors at each jamb. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  - 8. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
  - 9. 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 Standard Steel Doors:
    - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
    - b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch .
    - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
    - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
  - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
  - 3. Smoke-Control Doors: Install doors according to NFPA 105.
- D. Glazing: Comply 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 Surfaces: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 08 14 00  
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Solid-core doors with wood-veneer and medium-density overlay faces.
  - 2. Factory finishing for wood doors.
  - 3. Factory glazing for wood doors.
  - 4. Factory fitting flush wood doors to frames and factory machining for hardware.

1.2 SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction, 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; location and extent of hardware blocking; and other pertinent data.
  - 1. Indicate dimensions and locations of mortises and holes for hardware.
  - 2. Indicate dimensions and locations of cutouts.
  - 3. Indicate requirements for veneer matching.
  - 4. Indicate doors to be factory finished and finish specifications.
  - 5. Indicate fire ratings for fire doors.
- C. Samples for Verification:
  - 1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
  - 2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."
- C. WDMA I.S.1-A Performance Grade: Extra Heavy Duty.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
  - 1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.

2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
  - E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.
  - F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- 1.4 DELIVERY, STORAGE, AND HANDLING
- A. Comply with requirements of referenced standard and manufacturer's written instructions.
  - B. Package doors individually in plastic bags.
  - C. Mark each door on top and bottom rail with opening number used on Shop Drawings.
- 1.5 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install doors until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- 1.6 WARRANTY
- A. Special Warranty: Manufacturer's standard form, signed by manufacturer, Installer, and Contractor, in which manufacturer agrees to repair or replace doors that are defective in materials or workmanship, have warped (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section, or show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
    1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
    2. Warranty shall include hardware installation and replacement of glass and glazing.
    3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
      - a. Solid-Core Interior Doors: Life of installation.
- 1.7 PROJECT CONDITIONS
- A. Environmental Limitations: Do not deliver or install woodwork 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.
    1. The HVAC systems as specified elsewhere will not provide for humidity controls. The building will be air conditioned in summer months. The ranges of relative humidity are expected to be as high as 70% to an uncontrolled low during the heating season. Comply with AWS Section 2, Care and Storage.
    2. Contractor shall assume full responsibility for fabricating interior architectural woodwork to not deteriorate in the interior environment expected during occupancy, which is standard for the majority of new buildings designed and constructed.
      - a. Submission of bid shall represent acceptance of these terms.

- b. Contrary manufacturer's and AWI disclaimers shall not apply if more restrictive than the conditions stated herein, as more stringent conditions are not typically provided in academic buildings.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Flush Wood Doors:
    - a. Algoma Hardwoods Inc.
    - b. Eggers Industries; Architectural Door Division.
    - c. Lambton Doors.
    - d. Marshfield Door Systems.

### 2.2 DOOR CONSTRUCTION, GENERAL

- A. Provide doors made with adhesives and composite wood products that contain no added urea formaldehyde.
- B. Doors for Transparent Finish:
  - 1. Grade for Appearance: AWI Premium, with AWI Grade A faces.
  - 2. Species and Cut: Clear White Maple, plain sawn.
  - 3. Match between Veneer Leaves: book match.
  - 4. Assembly of Veneer Leaves on Door Faces: Center balanced.
  - 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
  - 6. Stiles: Same species as faces.
  - 7. Cross-Banding: 1/8 in. high density fiberboard, urea formaldehyde free.
  - 8. Adhesives: Type I per WDMA T.M.-6.

### 2.3 SOLID-CORE DOORS

- A. Cores: Comply with the following requirements:
  - 1. Particle Core: ANSI A 208.1, Grade 1-LD-2
  - 2. Stave Lumber Core: FSC Certified
  - 3. Structural Composite Lumber Core: Timberstrand LSL,
  - 4. Provide doors with structural composite lumber cores instead of particleboard cores at locations where exit devices are indicated or where light cutouts exceed 40% of the door area.
- B. Interior Veneer-Faced Doors:
  - 1. Construction: Five plies, hot-pressed, with stiles and rails bonded to core, then entire unit abrasive planed before veneering.
- C. Fire-Rated Doors:
  - 1. Construction: Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as needed to provide fire rating indicated.
    - a. Fire Retardant Mineral Core, with no added urea formaldehyde cross-banding, contributes to IEQ 4.4.

2. Blocking: For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.
  - a. Screw-Holding Capability: 550 lbf per WDMA T.M.-10.
4. Pairs: Provide fire-rated pairs with fire-retardant stiles matching face veneer that are labeled and listed for kinds of applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals.

## 2.4 GLAZING SYSTEMS

- A. Glazing: Provide factory installed glass products in accordance with requirements in Section 08 80 00 - GLAZING.

## 2.5 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors:
  1. Wood Species: Same species as door faces.
  2. Profile: Manufacturer's standard shape.
  3. At 20-minute, fire-rated, wood-core doors, provide wood beads and metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire rating indicated. Include concealed metal glazing clips where required for opening size and fire rating indicated.

## 2.6 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated, with the following uniform clearances and bevels, unless otherwise indicated:
  1. Comply with clearance requirements of referenced quality standard for fitting. Comply with requirements in NFPA 80 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, DHI A115-W series standards, and hardware templates.
  1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining. Drill pilot holes for screws for butt hinges and lock fronts at the factory.
  2. Metal Astragals: Premachine astragals and formed-steel edges for hardware for pairs of fire-rated doors to receive concealed vertical rod exit devices.
- C. Transom and Side Panels: Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
  1. Fabricate door and transom panels with full-width, solid-lumber meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal doorframes.
- D. Openings: Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

## 2.7 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Section 09 90 00 - PAINTING.

## 2.8 FACTORY FINISHING

- A. General: Comply with AWI's "Architectural Woodwork Quality Standards Illustrated" for factory finishing.
- B. Finish doors at factory that are indicated to receive transparent finish. Factory prime and prepare for field finish doors indicated to receive opaque finish.
- C. Transparent Finish:
  1. Grade: Premium.
  2. Finish: WDMA TR-6 catalyzed polyurethane.
  3. Staining: Custom stain.
  4. Effect: Semifilled finish.
  5. Sheen: Satin.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION

- A. Hardware: For installation, see Section 08 71 00 - DOOR HARDWARE.
- B. Manufacturer's Written Instructions: Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.
  1. Install fire-rated doors in corresponding fire-rated frames 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.

### 3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Protection: Provide temporary protection to ensure work being without damage or deterioration at time of final acceptance. Remove protections and reclean as necessary immediately before final acceptance.



- C. Finished Doors: Replace doors that are damaged or 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 083110  
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Access doors and frames for walls and ceilings.

1.2 SUBMITTALS

- A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components, profiles, and finishes.
- B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material, at least 3 by 5 inches in size, in specified finish.
- D. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- E. Ceiling Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted items including access doors and frames, lighting fixtures, diffusers, grilles, speakers, sprinklers, and special trim are shown and coordinated with each other.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of access door and frame through one source from a single manufacturer.
- B. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. NFPA 252 for vertical access doors and frames.
  - 2. ASTM E 119 for horizontal access doors and frames.
- C. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.4 COORDINATION

- A. Verification: Determine specific locations and sizes for access doors needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

## PART 2 - PRODUCTS

### 2.1 STEEL MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
- B. Steel Sheet: 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. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
    - a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
  - 2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
- D. Drywall Beads: Edge trim formed from 0.0299-inch zinc-coated steel sheet formed to receive joint compound and in size to suit thickness of gypsum board.

### 2.2 STAINLESS-STEEL MATERIALS

- A. Rolled-Stainless-Steel Floor Plate: ASTM A 793, manufacturer's standard finish.
- B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 316. Remove tool and die marks and stretch lines or blend into finish.
  - 1. Finish: Directional Satin Finish, No. 4.

### 2.3 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Acudor Products, Inc.
  - 2. Babcock-Davis; A Cierra Products Co.
  - 3. Dur-Red Products.
  - 4. J. L. Industries, Inc.
  - 5. Karp Associates, Inc.
  - 6. Larsen's Manufacturing Company.
  - 7. Milcor Inc.
  - 8. Nystrom, Inc.
- B. Flush Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Door: Minimum 0.060-inch-thick sheet metal, set flush with surrounding finish surfaces.
  - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead flange.
  - 4. Hinges: Continuous piano.
  - 5. Lock: Cylinder.

- a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00, DOOR HARDWARE.
- C. Recessed Access Doors and Trimless Frames: Fabricated from steel sheet at typical areas and from stainless-steel sheet at toilet and wet areas.
  - 1. Locations: Wall and ceiling surfaces.
  - 2. Door: Minimum 0.060-inch-thick sheet metal in the form of a pan recessed 5/8 inch for gypsum board infill.
  - 3. Frame: Minimum 0.060-inch-thick sheet metal with drywall bead for gypsum board surfaces.
  - 4. Lock: Cylinder.
    - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00, DOOR HARDWARE.
- D. Fire Rated, Uninsulated, Flush Access Doors and Frames with Exposed Trim: Fabricated from steel at typical areas and from stainless-steel sheet at toilets and wet areas.
  - 1. Locations: Wall surfaces.
  - 2. Fire-Resistance Rating: Not less than that of adjacent construction.
  - 3. Door: Minimum 0.060-inch-thick sheet metal, flush construction.
  - 4. Frame: Minimum 0.060-inch-thick sheet metal with 1-inch-wide, surface-mounted trim.
  - 5. Hinges: Continuous piano.
  - 6. Automatic Closer: Spring type.
  - 7. Lock: Self-latching device with cylinder lock.
    - a. Lock Preparation: Prepare door panel to accept cylinder specified in Section 08 71 00, DOOR HARDWARE

## 2.4 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 attachment devices and fasteners of type required to secure access panels to types of supports indicated.
  - 1. For trimless frames with drywall bead, provide edge trim for gypsum board and gypsum base securely attached to perimeter of frames.
  - 2. For trimless frames with plaster bead for full-bed plaster applications, provide zinc-coated expanded metal lath and exposed casing bead welded to perimeter of frames.
  - 3. Provide mounting holes in frames for attachment of units to metal or wood framing.
  - 4. Provide mounting holes in frame for attachment of masonry anchors.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
  - 1. For recessed doors with plaster infill, provide self-furring expanded metal lath attached to door panel.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
  - 1. For cylinder lock, furnish two keys per lock and key all locks alike.

2. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.
- C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

#### 3.2 ADJUSTING AND CLEANING

- A. Adjust doors and hardware after installation for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 71 00 – DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
1. Swinging doors.
  2. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
1. Mechanical door hardware.
  2. Cylinders specified for doors in other sections.
- C. Related Sections:
1. Division 06 Section “Rough Carpentry”.
  2. Division 06 Section “Finish Carpentry”.
  3. Division 08 Section “Hollow Metal Doors and Frames”.
  4. Division 08 Section “Interior Aluminum Doors and Frames”.
  5. Division 08 Section “Flush Wood Doors”.
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
  2. ICC/IBC - International Building Code.
  3. NFPA 70 - National Electrical Code.
  4. NFPA 80 - Fire Doors and Windows.
  5. NFPA 101 - Life Safety Code.
  6. NFPA 105 - Installation of Smoke Door Assemblies.
  7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards:
1. ANSI/BHMA Certified Product Standards - A156 Series
  2. UL10C – Positive Pressure Fire Tests of Door Assemblies

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
  - 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
  - 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
  - 3. Content: Include the following information:
    - a. Type, style, function, size, label, hand, and finish of each door hardware item.
    - b. Manufacturer of each item.
    - c. Fastenings and other pertinent information.
    - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - e. Explanation of abbreviations, symbols, and codes contained in schedule.
    - f. Mounting locations for door hardware.
    - g. Door and frame sizes and materials.
    - h. Warranty information for each product.
  - 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- D. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
- B. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- D. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
- E. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.
- F. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
  1. Function of building, purpose of each area and degree of security required.
  2. Plans for existing and future key system expansion.
  3. Requirements for key control storage and software.
  4. Installation of permanent keys, cylinder cores and software.
  5. Address and requirements for delivery of keys.
- G. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.



1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
  2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
  3. Review sequence of operation narratives for each unique access controlled opening.
  4. Review and finalize construction schedule and verify availability of materials.
  5. Review the required inspecting, testing, commissioning, and demonstration procedures
- H. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

#### 1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

#### 1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
  - 1. Structural failures including excessive deflection, cracking, or breakage.
  - 2. Faulty operation of the hardware.
  - 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 4. Electrical component defects and failures within the systems operation.
- C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
- D. Special Warranty Periods:
  - 1. Ten years for mortise locks and latches.
  - 2. Five years for exit hardware.
  - 3. Twenty five years for manual surface door closer bodies.

## 1.8 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

## PART 2 - PRODUCTS

### 2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
- C. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

## 2.2 HANGING DEVICES

- A. Hinges: ANSI/BHMA A156.1 certified butt hinges with number of hinge knuckles as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity, unless otherwise indicated:
    - a. Two Hinges: For doors with heights up to 60 inches.
    - b. Three Hinges: For doors with heights 61 to 90 inches.
    - c. Four Hinges: For doors with heights 91 to 120 inches.
    - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
  2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    - a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
    - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
  3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    - a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
  4. Hinge Options: Comply with the following where indicated in the Hardware Sets or on Drawings:
    - a. Non-removable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
  5. Acceptable Manufacturers:
    - a. Bommer Industries (BO).
    - b. Hager Companies (HA).
    - c. McKinney Products (MK).

## 2.3 DOOR OPERATING TRIM

- A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.
1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
  2. Furnish dust proof strikes for bottom bolts.
  3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
  5. Acceptable Manufacturers:
    - a. Door Controls International (DC).
    - b. Rockwood Manufacturing (RO).
    - c. Trimco (TC).
- B. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
  2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
  3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
  4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
  5. Acceptable Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Manufacturing (RO).
    - c. Trimco (TC).

## 2.4 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
- B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.
- C. Cylinders: Original manufacturer cylinders complying with the following:
  1. Mortise Type: Threaded cylinders with rings and cams to suit hardware application.
  2. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
  3. Bored-Lock Type: Cylinders with tailpieces to suit locks.
  4. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
  5. Keyway: Match Facility Standard.
- D. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:

1. Removable Cores: Core insert, removable by use of a special key, and for use with only the core manufacturer's cylinder and door hardware. Provide removable core (small or large format) as specified in Hardware Sets.
  - E. Keying System: Each type of lock and cylinders to be factory keyed.
    1. Conduct specified "Keying Conference" to define and document keying system instructions and requirements.
    2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
    3. Existing System: Key locks to Owner's existing system.
  - F. Key Quantity: Provide the following minimum number of keys:
    1. Change Keys per Cylinder: Two (2)
    2. Master Keys (per Master Key Level/Group): Five (5).
    3. Construction Keys (where required): Ten (10).
    4. Construction Control Keys (where required): Two (2).
    5. Permanent Control Keys (where required): Two (2).
  - G. Construction Keying: Provide temporary keyed construction cores.
  - H. Key Registration List (Bitting List):
    1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
    2. Provide transcript list in writing or electronic file as directed by the Owner.
- 2.5 MECHANICAL LOCKS AND LATCHING DEVICES
- A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 certified. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.
    1. Acceptable Manufacturers:
      - a. Corbin Russwin Hardware (RU) – ML2000 Series.
      - b. No Substitution.
  - B. Residential Tubular Locking Devices: Standard ANSI A156.2, Series 4000, Grade 2.
    1. Tubular locksets, deadbolts, and handlesets designed to fit ANSI standard door preps.
    2. Locks are to be non-handed and have adjustable backset.
    3. Acceptable Manufacturers:
      - a. Kwikset (KW) - Signature Series.
      - b. Schlage (SC) - TL Series.

- c. Yale Residential (YR) - YH Series.

## 2.6 AUXILIARY LOCKS

- A. Mortise Deadlocks, Small Case: ANSI/BHMA A156.36, Grade 1, small case mortise type deadlocks constructed of heavy gauge wrought corrosion resistant steel. Steel or stainless steel bolts with a 1" throw and hardened steel roller pins. Deadlocks to be products of the same source manufacturer and keyway as other specified locksets.

- 1. Acceptable Manufacturers:

- a. Corbin Russwin Hardware (RU) - DL4100 Series.
- b. No Substitution.

## 2.7 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
- 4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

- B. Standards: Comply with the following:

- 1. Strikes for Mortise Locks and Latches: BHMA A156.13.
- 2. Strikes for Bored Locks and Latches: BHMA A156.2.
- 3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
- 4. Dustproof Strikes: BHMA A156.16.

## 2.8 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

- 1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
  3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
  4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
  5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
    - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
    - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
  6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
  7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
  8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
  9. Rail Sizing: Provide exit device rails factory sized for proper door width application.
  10. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 certified panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.
1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) - ED4000 / ED5000 Series.
    - b. Sargent Manufacturing (SA) - 80 Series.
    - c. Von Duprin (VD) - 35A/98 XP Series.

## 2.9 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers including installation and adjusting information on inside of cover.
  2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
  3. Cycle Testing: Provide closers which have surpassed 15 million cycles in a test witnessed and verified by UL.
  4. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the physically handicapped, provide units complying with ANSI ICC/A117.1.
  5. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
  6. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
  7. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Acceptable Manufacturers:
    - a. Corbin Russwin Hardware (RU) – DC6000 Series.
    - b. LCN Closers (LC) - 4040 Series.
    - c. Norton Door Controls (NO) - 7500 Series.

## 2.10 ARCHITECTURAL TRIM

### A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and



not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:
  - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Acceptable Manufacturers:
  - a. Burns Manufacturing (BU).
  - b. Rockwood Manufacturing (RO).
  - c. Trimco (TC).

## 2.11 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
  1. Acceptable Manufacturers:
    - a. Hiawatha, Inc. (HI).
    - b. Rockwood Manufacturing (RO).
    - c. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.6, Grade 1 certified overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
  1. Acceptable Manufacturers:
    - a. Rixson Door Controls (RF).

- b. Rockwood Manufacturing (RO).
- c. Sargent Manufacturing (SA).

## 2.12 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.
- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
  - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
  - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Acceptable Manufacturers:
  - 1. National Guard Products (NG).
  - 2. Pemko Manufacturing (PE).
  - 3. Reese Enterprises, Inc. (RE).

## 2.13 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

## 2.14 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

#### 3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

#### 3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
  - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
  - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
  - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
  - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
  - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."
- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

### 3.4 FIELD QUALITY CONTROL

- A. Field Inspection: Supplier will perform a final inspection of installed door hardware and state in report whether work complies with or deviates from requirements, including whether door hardware is properly installed, operating and adjusted.

### 3.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

### 3.6 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

### 3.7 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
- B. Manufacturer's Abbreviations:
1. MK - McKinney
  2. RO - Rockwood
  3. RU - Corbin Russwin
  4. YR - Yale Residential
  5. RF - Rixson
  6. NO - Norton
  7. PE - Pemko

**Hardware Sets**

**Set: 1.0**

**NOT USED**

**Set: 2.0**

Doors: 1/602A, 1/602B, 1/602C, 1/602D, 1/602E, 1/613, 1/614, 1/616

6 Hinge	TA2714	US26D MK
1 Dust Proof Strike	570	US26D RO
2 Flush Bolt	555	US26D RO
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Door Closer	7500 / P7500	689 NO
2 Kick Plate	K1050 10" high BEV CSK	US32D RO
2 Door Stop	400 / 441CU	US26D RO
2 Silencer	608	RO

**Set: 3.0**

Doors: 1/604, 1/605, 1/611, 1/611A, 1/627

6 Hinge	TA2714	US26D MK
1 Dust Proof Strike	570	US26D RO
2 Flush Bolt	555	US26D RO
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Concealed Overhead Stop	2-X36	630 RF
1 Door Closer	7500 / P7500	689 NO
2 Kick Plate	K1050 10" high BEV CSK	US32D RO
1 Door Stop	400 / 441CU	US26D RO
2 Silencer	608	RO

**Set: 4.0**

Doors: 1/404, 1/406, 1/414A, 1/504, 1/509, 1/509A, 1/601, 1/602, 1/603, 1/613A, 1/615

3 Hinge	TA2714	US26D MK
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Door Closer	7500 / P7500	689 NO
1 Kick Plate	K1050 10" high BEV CSK	US32D RO
1 Door Stop	400 / 441CU	US26D RO
3 Silencer	608	RO

Notes: Provide 2 Series Overhead Stop where Floor/Wall Stop cannot be used.

**Set: 5.0**

Doors: 1/609, 2/609

4 Hinge	TA2714	US26D MK
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Door Closer	7500 / P7500	689 NO
1 Kick Plate	K1050 10" high BEV CSK	US32D RO
1 Door Stop	400 / 441CU	US26D RO

Notes: Provide 2 Series Overhead Stop where Floor/Wall Stop cannot be used.

**Set: 6.0**

Doors: 1/401, 1/405, 1/405L, 1/416, 1/417, 1/419, 1/420, 1/421, 1/425, 1/426, 1/510, 1/513, 1/518, 1/536, 1/539, 1/550, 1/552, 1/557, 1/558, 1/606, 1/610, 1/625, 1/631, 1/632, 1/633, 1/634

4 Hinge	TA2714	US26D MK
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Door Closer	7500 / P7500	689 NO
1 Kick Plate	K1050 10" high BEV CSK	US32D RO
1 Door Stop	400 / 441CU	US26D RO
1 Gasketing	S773BL	PE

Notes: Provide 10 Series Overhead Stop where Floor/Wall Stop cannot be used.

General Contractor to confirm existing frame will accept new hardware. Provide filler plates as required.

**Set: 7.0**

Doors: 1/405B, 1/405C, 1/405M, 1/405N, 1/405P, 1/414B, 1/414C, 1/414D, 1/414E

4 Hinge	TA2714	US26D MK
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Kick Plate	K1050 10" high BEV CSK	US32D RO
1 Door Stop	400 / 441CU	US26D RO

Notes: Provide 2 Series Overhead Stop where Floor/Wall Stop cannot be used.

**Set: 8.0**

Doors: 1/405J

4 Hinge	TA2714	US26D MK
1 Classroom Lock	ML2055 NSM CT6B	626 RU
1 Permanent Core	8000	626 RU
1 Kick Plate	K1050 10" high BEV CSK	US32D RO
1 Door Stop	400 / 441CU	US26D RO

Notes: Provide 10 Series Overhead Stop where Floor/Wall Stop cannot be used.

General Contractor to confirm existing frame will accept new hardware. Provide filler plates as required.

**Set: 9.0**

Doors: 1/612

3 Hinge	TA2714	US26D MK
1 Privacy Set	ML2060 NSM M19V	626 RU
1 Concealed Overhead Stop	2-X36	630 RF
1 Door Closer	7500 / P7500	689 NO
1 Kick Plate	K1050 10" high BEV CSK	US32D RO
3 Silencer	608	RO

**Set: 10.0**

**NOT USED**

**Set: 11.0**

**NOT USED**

**Set: 12.0**

Doors: 1/608B

4 Hinge	TA2714	US26D MK
1 Passage Latch	11 MC	619 YR
1 Door Stop	400 / 441CU	US26D RO
3 Silencer	608	RO

Notes: General Contractor to confirm existing frame will accept new hardware. Provide filler plates as required.

**Set: 13.0**

Doors: 1/608A

3 Hinge	TA2714	US26D MK
1 Privacy Lock	21 MC	619 YR
1 Door Stop	400 / 441CU	US26D RO
3 Silencer	608	RO

**Set: 14.0**

Doors: 1/608

4 Hinge	TA2714	US26D MK
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**New Jersey City University: Nursing Education Center  
Renovations to Rossey Hall**  
2039 John F. Kennedy Boulevard  
Jersey City, NJ 07305

**Clarke Caton Hintz  
Construction Documents**  
December 4, 2017

1 Apartment Lock	ML2067 FSL CT6B	626	RU
1 Kick Plate	K1050 10" high BEV CSK	US32D	RO
1 Door Stop	400 / 441CU	US26D	RO
1 Gasketing	S773BL		PE
1 Viewer	620	CRM	RO

END OF SECTION 087100

SECTION 08 80 00  
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. Work Included: The Work of this Section includes, but is not limited to the following:
  - 1. Clear tempered glass for typical interior doors, partitions, storefronts, and windows.

1.3 DEFINITIONS

- A. Manufacturers of Glass Products: 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. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.
- D. Deterioration of Insulating Glass: Evidence of failure is the obstruction of vision by dust, moisture, or film on interior surfaces of glass under normal use that is attributed to the manufacturing process. Failure excludes glass breakage and maintenance and cleaning of insulating glass contrary to manufacturer's written instructions.

1.4 PERFORMANCE REQUIREMENTS

- A. General: Provide glazing systems capable of withstanding normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.
- B. Glass Design: Glass thickness designations indicated are minimums and are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites in the thickness designations indicated for various size openings, but not less than thicknesses and in strengths (annealed or heat treated) required to meet or exceed the following criteria:
  - 1. Glass Thicknesses: Select minimum glass thicknesses to comply with ASTM E 1300, according to the following requirements:
    - a. Design Loads: As required by the State of New Jersey Building Code.
    - b. Maximum Lateral Deflection: For the following types of glass supported on all 4 edges, provide thickness required that limits center deflection at design wind pressure to 1/50 times the short side length or, whichever is less.

- 1) For monolithic-glass lites heat treated to resist wind loads.
  - 2) For insulating glass.
- C. Thermal Movements: Provide glazing that allows for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### 1.5 SUBMITTALS

- A. Product Data: For each glass product and glazing material indicated, submit manufacturers technical information, installation instructions and performance criteria.
- B. Samples: For each glass type, in the form of 12 inch square Samples for glass. Install sealant Samples between two strips of material representative in color of the adjoining framing system.
- C. Product Certificates: Signed by manufacturers of glass and glazing products certifying that products furnished comply with requirements.
- D. Preconstruction Adhesion and Compatibility Test Report: From glazing sealant manufacturer indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.
- E. Product Test Reports: For each of the following types of glazing products:
  1. Glazing sealants.

#### 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance; and who employs glass installers for this Project who are certified under the referenced standards Certified Glass Installer Program.
- B. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- C. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
  1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Elastomeric Glazing Sealant Product Testing: Obtain sealant test results for product test reports in "Submittals" Article from a qualified testing agency based on testing current sealant formulations within a 36-month period.

1. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.
  2. Test elastomeric glazing sealants for compliance with requirements specified by reference to ASTM C 920, and where applicable, to other standard test methods.
- F. Preconstruction Adhesion and Compatibility Testing: Submit to elastomeric glazing sealant manufacturers, for testing indicated below, samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that will contact or affect elastomeric glazing sealants:
1. Use ASTM C 1087 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
  2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
  3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
  4. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
  5. Testing will not be required if elastomeric glazing sealant manufacturers submit data based on previous testing of current sealant products for adhesion to, and compatibility with, glazing materials matching those submitted.
- G. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
1. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites:
    - a. More than in exposed surface area of one side, provide glazing products that comply with Category II materials, for lites
    - b. Less in exposed surface area of one side, provide glazing products that comply with Category I or II materials, except for hazardous locations where Category II materials are required by 16 CFR 1201 and regulations of authorities having jurisdiction.
- H. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, unless more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.
1. GANA Publications: GANA's "Glazing Manual."
  2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "Glazing Guidelines for Sealed Insulating Glass Units."
  3. Authorities having jurisdiction.

### 1.7 DELIVERY, STORAGE, AND HANDLING

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

### 1.8 PROJECT 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 glazing sealant manufacturer or below.

### 1.9 WARRANTY

- A. General: Submit warranties to repair or replace defective glass and glazing materials or workmanship for a period of not less than 5 years after date of Substantial Completion, or longer where specified.
- B. Insulating Glass: Manufacturer's standard form, made out to Owner and signed by insulating glass manufacturer agreeing to replace insulating-glass units that deteriorate as defined in "Definitions" Article. Submit a written warranty agreeing to replace defective insulating glass for a period of 10 years after date of Substantial Completion. Defects include, but are not limited to the following:
  - 1. Failure of insulating glass edge seal as shown by frost, moisture, dust or corrosion within sealed air space
  - 2. Insulating glass spacer migration.
  - 3. Failure to meet specified performance requirements.

## PART 2 - PRODUCTS

### 2.1 GLASS PRODUCTS

- A. Glass, General: All glass of the same type shall be the manufactured product of one company. Provide glass types for each application according to the glazing schedule found in part three of this section.
  - 1. Glass Types: Refer to the Drawings and Finish Schedules for glass products, descriptions, sizes, locations, patterns, and frames/trim (where applicable).
- B. Fabrication Process: By horizontal (roller-hearth) process. Glass heat treatment should run in one direction as installed in the building. Direction is subject to Architect's approval.
  - 1. Resulting heat treated glass shall minimize the "roller distortion" or "ripples" resulting from fabrication. Where noticeable distortions exist, and are acceptable to the Architect, install glass with such distortions running horizontally.

2. Glass within one type of opening shall be produced by the same heat treating process.
- C. Primary Glass Requirements:
1. Clear Float Glass: ASTM C 1036; Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).
- D. Uncoated Clear Heat-Treated Float Glass: ASTM C 1048; Condition A (uncoated surfaces), Type 1 (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), Kind FT (fully tempered).
1. Thickness: 1/4 inch, unless otherwise indicated.
- E. Flat Glass Mirrors: Clear glass, complying with ASTM C 1503; Mirror Select Quality, with beveled and polished edges.
1. Nominal Thickness: 1/4 inch, unless otherwise indicated.
  2. Hardware: Steel clips, angles supports and fasteners as required for mirror wall units.
- F. One-way Vision Glass: a. "Mirropane" manufactured by Libby-Owens-Ford Co.; 1/4" thick glazing quality, tempered clear glass with scratch-proof evaporated chromium alloy reflective coating one side, PPG Industries, Inc., or equal.

## 2.2 GLAZING ACCESSORIES

- A. Dense Compression Gaskets: Molded or extruded gaskets of profile and hardness required to maintain watertight seal, made from one of the following:
1. Neoprene complying with ASTM C 864.
  2. EPDM complying with ASTM C 864.
  3. Silicone complying with ASTM C 1115.
  4. Thermoplastic polyolefin rubber complying with ASTM C 1115.

## 2.3 GLAZING SEALANTS AND SEALANT BACKING MATERIAL

- A. General: Provide products of type indicated, complying with the following requirements:
1. Compatibility: Select glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
  2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- B. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based elastomeric tape with a solids content of 100 percent; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for

application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800.

- C. Silicone Compounds, General: Where indicated provide silicone sealants complying with ASTM C 1193 which are specifically designed and tested for use as structural silicone sealant Secondary seal or weatherseal silicone sealants shall be compatible with the neutral cure structural silicone sealant. Weatherseal shall accommodate a 50 percent increase or decrease of joint width as measured at time of application in accordance with ASTM C 719.
- D. Sealant Backing Materials: Preformed foam plastics and synthetic rubbers, compressible, nongassing, non staining, and compatible with sealants and as recommended by sealant manufacturers. Backing shall be of the sizes and shapes to suit the various conditions and shall be a color different than the sealant color. Backer rods shall be 25 percent wider than the joint width.
  - 1. 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.
- E. Elastomeric Glazing Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

#### 2.4 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, 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, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions with a Shore, Type A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Mirror Mastic: An adhesive setting compound, asbestos-free, produced specifically for setting mirrors and certified by both mirror manufacturer and mastic manufacturer as compatible with glass coating and substrates on which mirrors will be installed.
- G. Film Backing for Safety Mirrors: Film backing and pressure-sensitive adhesive; both compatible with mirror backing paint as certified by mirror manufacturer.

#### 2.5 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to glaze 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.

- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with outdoor and indoor faces.
- C. Grind smooth and polish exposed glass edges and corners.
- D. Mirror Edge Treatment: Beveled and polished, unless otherwise indicated.
  - 1. Seal edges of mirrors with edge sealer after edge treatment to prevent chemical or atmospheric penetration of glass coating.
  - 2. Require mirror manufacturer to perform edge treatment and sealing in factory immediately after cutting to final sizes.
- E. Film-Backed Safety Mirrors: Apply film backing with adhesive coating over mirror backing paint as recommended in writing by film-backing manufacturer to produce a surface free of bubbles, blisters, and other imperfections.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Examine framing glazing, 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 system.
  - 3. Minimum required face or 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.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Provide glazing channel dimensions, to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances.
- C. Protect glass edges from damage during handling and installation. Remove damaged glass



from Project site and legally dispose of off Project site. Damaged glass is glass with edge damage or other imperfections that, when installed, could weaken glass and impair performance and appearance.

- D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant-substrate 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 as follows:
  - 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 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. 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 GASKET GLAZING (DRY)

- A. Fabricate compression gaskets in 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. 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. Install gaskets so they protrude past face of glazing stops.

### 3.5 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

### 3.6 MIRROR INSTALLATION

- A. General: Install mirrors to comply with mirror manufacturer's written instructions and with referenced GANA publications. Mount mirrors accurately in place in a manner that avoids distorting reflected images.
- B. Wall-Mounted Mirrors: Install mirrors with mastic, angles, Z-clips, and/or mirror hardware. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable. Install fasteners so heads do not impose point loads on backs of mirrors.
  - 1. Fasten Clips directly to wall substrate or back-up framing. Locate clips where indicated and locate so that they are symmetrically placed and evenly spaced.
  - 2. Where required, install mastic as follows:
    - a. Apply barrier coat to mirror backing where approved in writing by manufacturers of mirrors and backing material.
    - b. After mastic is applied, align mirrors and press into place while maintaining a minimum air space of 1/8 inch between back of mirrors and mounting surface.
- C. Protect mirrors from breakage and contaminating substances resulting from construction operations.
- D. Do not permit edges of mirrors to be exposed to standing water.
- E. Maintain environmental conditions that will prevent mirrors from being exposed to moisture from condensation or other sources for continuous periods of time.

### 3.7 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface unless required for certification purposes. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove substances immediately as recommended by glass manufacturer.

- C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains; remove as recommended in writing by glass manufacturer.
- D. Remove and replace glass that is broken, chipped, cracked, or abraded or that is damaged from natural causes, accidents, and vandalism, during construction period.
- E. 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 08 80 00

SECTION 09 21 10  
GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  1. Interior gypsum wallboard.
  2. Tile backing panels.
  3. Abuse-resistant gypsum board; at corridors and common areas.
  4. Acoustic insulation in gypsum wallboard assemblies.
  5. Non-load-bearing steel framing.
  6. Marking and identification for fire- and smoke-partitions.

1.2 COORDINATION

- A. Coordinate with Section 07 21 00 – THERMAL INSULATION for installation of metal furring at mineral-board insulation at interior face of building perimeter.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide fire stop tracks capable of withstanding deflection within limits and under conditions indicated.
  1. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling above ceilings. Such identification shall:
  1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
  2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
  3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," or other wording.
  4. Exception: Walls that do not have a removable decorative ceiling allowing access to the concealed space.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.5 QUALITY ASSURANCE

- 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: 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. Drywall Recycling: All new paper-faced gypsum wallboard scrap (cuts from construction but not demolition waste) shall be recycled by Gypsum Recycling America LLC or approved equal.
- D. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Install mockups for the following:
    - a. Each level of gypsum board finish indicated for use in exposed locations.
    - b. Each texture finish indicated.
  - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
  - 3. Simulate finished lighting conditions for review of mockups.
  - 4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

#### 1.6 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 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 GENERAL

- A. Regional Materials: Products, including raw materials, to be regionally sourced, extracted, and manufactured within 500 miles of Project Site.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Recycled Content of Gypsum Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

#### 2.2 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- 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: Manufacturer's standard corrosion-resistant zinc coating, unless otherwise indicated.

## 2.3 SUSPENSION SYSTEM COMPONENTS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.0625-inch-diameter wire, or double strand of 0.0475-inch-diameter wire.
- B. Hanger Attachments to Concrete:
  1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.
    - a. Type: Postinstalled, expansion anchor.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.0538 inch and minimum 1/2-inch-wide flanges with depth as required for span and loading and indicated on Drawings.
- E. Furring Channels (Furring Members): 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
- F. Grid Suspension System for Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Furring System.
    - c. USG Corporation; Drywall Suspension System.

## 2.4 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.
  1. Stud Minimum Base-Metal Thickness: 0.0346 inch (20 gage).
- B. Slip-Type Head Joints: Provide one of the following:
  1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
  2. 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.
  3. 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.
    - a. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Steel Network Inc. (The); VertiClip Series.

2) Superior Metal Trim; Superior Flex Track System (SFT).

- C. Fire Stop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness compatible with studs and in width to accommodate depth of studs.
  - 1. Grace Construction Products; FlameSafe FlowTrak System.
  - 2. Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
  - 3. Metal-Lite, Inc.; The System.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: 0.0312 inch.
- E. Cold-Rolled Channel Bridging: 0.0538-inch bare-steel thickness, with minimum 1/2-inch-wide flanges.
  - 1. Depth: 1-1/2 inches.
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base Metal Thickness: 0.0312 inch.
  - 2. Depth: 1-1/2 inches, unless otherwise indicated.
- G. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: Asymmetrical or hat shaped.
- H. Resilient Sound Isolation Clips: Provide galvanized steel and resilient material sound-isolation clips, equal to the following:
  - 1. Kinetics Noise Control Co.; IsoMax.
  - 2. PAC International, Inc.; RSIC-1.
  - 3. Pliteq, Inc.; GenieClip.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum bare-metal thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.
- J. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- K. Isolation Strip at Exterior Walls: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

2.5 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. USG Corporation.
  - 2. Georgia-Pacific (G-P) Gypsum LLC.
  - 3. National Gypsum Company.
- B. Gypsum Wallboard: ASTM C 1396.
  - 1. Thickness: 5/8 inch, or as otherwise indicated.
  - 2. Long Edges: Tapered.

- C. Fire-Resistant Type X: ASTM C 1396.
  - 1. Thickness: 5/8 inch.
  - 2. Long Edges: Tapered.
- D. Flexible Type: ASTM C 1396. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
  - 1. Thickness: 1/4 inch.
  - 2. Long Edges: Tapered.
- E. Ceiling Type: Manufactured to have more sag resistance than regular-type gypsum board.
  - 1. Thickness: 1/2 inch.
  - 2. Long Edges: Tapered.
- F. Abuse-Resistant Type: ASTM C 1629. Manufactured to produce greater resistance to surface indentation and through-penetration (impact resistance) than standard, regular-type and Type X gypsum board.
  - 1. Core: 5/8 inch, Type X.
  - 2. Long Edges: Tapered.
- G. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396. With moisture- and mold-resistant core and paper surfaces.
  - 1. Core: 5/8 inch, Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.6 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 and ASTM C 1288 or 1325, with manufacturer's standard edges.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Custom Building Products; Wonderboard.
    - b. FinPan, Inc.; Util-A-Crete Concrete Backer Board.
    - c. National Gypsum Company; Permabase Cement Board.
    - d. USG Corporation; DUROCK Cement Board.
  - 2. Thickness: 5/8 inch.
  - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.

## 2.7 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
  - 2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. Expansion (control) joint.
    - e. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Fry Reglet Corp. (Basis-of-Design)
  - 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: Corrosion-resistant primer compatible with joint compound and finish materials specified.
4. Basis-of-Design Shapes:
  - a. Drywall Molding End Closure; Fry Reglet; size as required by partition depth.
  - b. Reveal Base Molding; Fry Reglet; reveal depth and height as indicated.
  - c. Additional shapes as indicated on Drawings.

## 2.8 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  1. Interior Gypsum Wallboard: Paper.
  2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
  1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
  3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.
- D. Joint Compound for Tile Backing Panels:
  1. Cementitious Backer Units: As recommended by backer unit manufacturer.
  2. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

## 2.9 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate, and compliant with VOC requirements per Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.
- 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.
    - 2. Thickness: Full thickness of stud cavity.
  
  - E. Acoustical Sealant: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
    - 1. Provide materials that comply with the VOC limits required per in Section 018110 – Sustainable Design Requirements.
    - 2. Acoustical Sealant for Exposed and Concealed Joints:
      - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
      - b. USG Corporation.; SHEETROCK Acoustical Sealant.
  
    - 3. Acoustical Sealant for Concealed Joints:
      - a. Ohio Sealants, Inc.; Pro-Series SC-170 Rubber Base Sound Sealant.
      - b. Pecora Corp.; BA-98.
      - c. Tremco, Inc.; Tremco Acoustical Sealant.
- 2.10 IDENTIFICATION LABELS for Fire- and Smoke-Partitions
- A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.
    - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - a. Fire Wall Signs, Inc.
      - b. Safety Supply Warehouse.
  
    - 2. Text: "FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS"

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
  
- 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 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.
  
- B. Coordination with Sprayed Fire-Resistive Materials:

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754. Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies, where indicated, and where otherwise required to complete the work. Do not install bracing to bridge double rows of studs forming acoustical separation assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than those required by referenced installation standards for assembly types and other assembly components indicated.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. 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. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.

6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. 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.

### 3.5 INSTALLING FRAMED ASSEMBLIES

- A. Install studs at a maximum of 16-inch centers.
- 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 penetrating 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 doorframes; 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 not less than 2 studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring: Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Furring Members:
  - 1. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches o.c.
  - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
  - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

### 3.6 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

### 3.7 APPLYING INTERIOR GYPSUM BOARD

- A. Single-Layer Application:
  - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  - 2. On partitions/walls, apply gypsum panels to minimize end joints.
  - 3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
  
- B. Multilayer Application:
  - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  - 2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over 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. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  - 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
  
- C. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.
  
- D. Curved Surfaces:
  - 1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
  - 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

### 3.8 APPLYING TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A108.1, at locations indicated to receive tile, with joints treated to comply with ANSI A108.11.
  
- B. Water-Resistant Backing Board: Install at areas not subject to wetting and elsewhere as indicated with 1/4-inch gap where panels abut other construction or penetrations.
  
- C. Where tile backing panels abut other types of panels in same plane, shim surfaces to produce a uniform plane across panel surfaces.

### 3.9 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 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. LC-Bead: Use at exposed panel edges.
  - 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in locations indicated on Drawings.

### 3.10 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 those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below:
  - 1. Level 1: Ceiling plenum areas and concealed areas not exposed to view.
  - 2. Level 2: Panels that are substrate for tile.
  - 3. Level 4: Panels in mechanical and electrical rooms, housekeeping closets and above ceilings.
  - 4. Level 5: In occupied areas where exposed to view.
    - a. Apply product in accordance with manufacturer's written instructions, to achieve a smooth surface.
    - b. Per GA 214 with spray-applied skim coat.
    - c. Spray-Applied Skim Coat/Primer: Vinyl acrylic latex-based coating for application in lieu of joint compound skim coat.
    - d. Basis-of-Design: USG Sheetrock Brand "Tuff-Hide" or comparable product.
- E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

### 3.11 INSTALLING Identification for Fire- and Smoke-Partitions

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

### 3.12 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION



SECTION 09 21 20  
GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Gypsum board shaft wall assemblies.
  - 2. Marking and identification for fire- and smoke-partitions.

1.2 COORDINATION

- A. Coordinate with the requirements of Section 09 21 16 – GYPSUM BOARD ASSEMBLIES for shaft-wall assembly finishing requirements at exposed surfaces.

1.3 DEFINITIONS

- A. Gypsum Board Construction Terminology: Refer to ASTM C 11 for definitions of terms for gypsum board construction not defined in this Section or in other referenced standards.

1.4 PERFORMANCE REQUIREMENTS

- A. Structural Performance:
  - 1. Provide gypsum board shaft wall assemblies capable of withstanding the full air-pressure loads indicated for maximum heights of partitions without failing and while maintaining an airtight and smoke-tight seal. Evidence of failure includes deflections exceeding limits indicated, bending stresses causing studs to break or to distort, and end-reaction shear causing track (runners) to bend or to shear and studs to become crippled.
  - 2. Provide gypsum board shaft wall assemblies for horizontal duct enclosures capable of spanning distances indicated within deflection limits indicated.
- B. Marking and Identification for Fire- and Smoke-Partitions: Fire walls, fire barriers, fire partitions, smoke barriers, smoke partitions and other walls required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling. Such identification shall:
  - 1. Be located in accessible concealed floor, floor-ceiling or attic spaces; and
  - 2. Be repeated at intervals not exceeding 30 feet measured horizontally along the wall or partition; and
  - 3. Include lettering not less than 0.5 inch in height, incorporating the suggested wording: "FIRE AND/OR SMOKE BARRIER-PROTECT ALL OPENINGS," or other wording.
  - 4. Exception: Walls in Group R-2 occupancies that do not have a removable decorative ceiling allowing access to the concealed space.

1.5 SUBMITTALS

- A. Product Data: For each gypsum board shaft wall assembly indicated.
- B. Fire-Test-Response Reports: From a qualified independent testing and inspecting agency substantiating each gypsum board shaft wall assembly's required fire-resistance rating.

1. Include data substantiating that elevator entrances and other items that penetrate each gypsum board shaft wall assembly do not negate fire-resistance rating.

#### 1.6 QUALITY ASSURANCE

- A. Fire-Resistance-Rated Assemblies: Provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.
  1. Fire-Resistance-Rated Assemblies: Indicated by design designations from FM's "Approval Guide, Building Products," UL's "Fire Resistance Directory," or ITS's "Directory of Listed Products."
- B. STC-Rated Assemblies: Provide assembly materials and construction complying with requirements of assemblies whose STC ratings were determined according to ASTM E 90 and classified according to ASTM E 413 by a qualified independent testing agency.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 01. Review methods and procedures for installing work related to gypsum board shaft wall assemblies including, but not limited to, the following:
  1. Fasteners proposed for anchoring steel framing to building structure.
  2. Sprayed fire-resistive materials applied to structural framing.
  3. Elevator equipment, including hoistway doors, elevator call buttons, and elevator floor indicators.
  4. Wiring devices in shaft wall assemblies.
  5. Doors and other items penetrating shaft wall assemblies.
  6. Items supported by shaft wall-assembly framing.
  7. Mechanical work enclosed within shaft wall assemblies.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, and bundles bearing brand name and identification of manufacturer or supplier.
- B. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Stack gypsum panels flat on leveled supports off the ground to prevent sagging.

#### 1.8 PROJECT CONDITIONS

- A. Comply with requirements for environmental conditions, room temperatures, and ventilation specified in Section 09 21 16 – GYPSUM BOARD ASSEMBLIES.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. American Gypsum Co.
  2. G-P Gypsum Corp.
  3. National Gypsum Company.
  4. United States Gypsum Co.

## 2.2 ASSEMBLY MATERIALS

- A. General: Provide materials and components complying with requirements of fire-resistance-rated assemblies indicated.
  - 1. Provide panels in maximum lengths available to eliminate or minimize end-to-end butt joints.
  - 2. Provide auxiliary materials complying with gypsum board shaft wall assembly manufacturer's written recommendations.
- B. Steel Framing: ASTM C 645.
  - 1. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized coating.
- C. Gypsum Liner Panels: Manufacturer's proprietary liner panels in 1-inch thickness, moisture-and mold-resistant Type X.
- D. Gypsum Wallboard: ASTM C 1396, core type as required by fire-resistance-rated assembly indicated.
- E. Accessories: Cornerbead, edge trim, and control joints of material and shapes specified in Section 09 21 16 – GYPSUM BOARD ASSEMBLIES comply with gypsum board shaft wall assembly manufacturer's written recommendations for application indicated.
- F. Gypsum Wallboard Joint-Treatment Materials: ASTM C 475 and as specified in Section 09 21 16 – GYPSUM BOARD ASSEMBLIES.
- G. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
- H. Track (Runner) Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
  - 1. Powder-Actuated Fasteners: Provide powder-actuated fasteners with capability to sustain, without failure, a load equal to 10 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 1190.
  - 2. Postinstalled Expansion Anchors: Where indicated, provide expansion anchors with capability to sustain, without failure, a load equal to 5 times that imposed by shaft wall assemblies, as determined by testing conducted by a qualified independent testing agency according to ASTM E 488.
- I. Laminating Adhesive: Adhesive or joint compound recommended by manufacturer for directly adhering gypsum face-layer panels and gypsum-base face-layer panels to backing-layer panels in multilayer construction.
- J. Acoustical Sealant: As recommended by gypsum board shaft wall assembly manufacturer for application indicated.
- K. Sound Attenuation Blankets: ASTM C 665 for Type I, unfaced mineral-fiber-blanket insulation produced by combining thermosetting resins with mineral fibers manufactured from slag or rock wool.

### 2.3 GYPSUM BOARD SHAFT WALL

- A. Basis-of-Design Product: As indicated on Drawings by design designation of a qualified testing and inspecting agency.
- B. Sustained Air-Pressure Loads: 5 lbf/sq. ft.
- C. Deflection Limit: L/240.
- D. Studs: Manufacturer's standard profile for repetitive members and corner and end members and for fire-resistance-rated assembly indicated.
  - 1. Depth: As indicated or required for the indicated conditions and required performance.
  - 2. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- E. Track (Runner): Manufacturer's standard J-profile track with long-leg length as standard with manufacturer, but at least 2 inches in depth matching studs.
  - 1. Minimum Base Metal Thickness: Manufacturer's standard thicknesses that comply with structural performance requirements for stud depth indicated.
- F. Jamb Struts: Manufacturer's standard J-profile strut with long-leg length of 3 inches, in depth matching studs, and not less than 0.0341 inch thick.
- G. Room-Side and Shaft-Side Finish: As indicated.
- H. STC Rating: Provide full thickness acoustical batt insulation in framing cavity.
- I. Cavity Insulation: Sound attenuation blankets.

### 2.4 IDENTIFICATION LABELS for Fire- and Smoke-Partitions

- A. Identification Labels: Vinyl adhesive signs, to comply with applicable local Code.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Fire Wall Signs, Inc.
    - b. Safety Supply Warehouse.
  - 2. Text: "FIRE AND SMOKE BARRIER-PROTECT ALL OPENINGS"

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates to which gypsum board shaft wall assemblies attach or abut, with Installer present, including hollow-metal frames, elevator hoistway doorframes, cast-in anchors, and structural framing. Examine for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive

materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 078100 - APPLIED FIREPROOFING.

1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of gypsum board assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

### 3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated, manufacturer's written installation instructions, and the following:
  1. ASTM C 754 for installing steel framing and gypsum shaft wallboard.
- B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, and similar items that cannot be supported directly by shaft wall assembly framing.
  1. At elevator hoistway doorframes, provide jamb struts on each side of doorframe.
  2. Where handrails directly attach to gypsum board shaft wall assemblies, provide galvanized steel reinforcing strip with 0.0312-inch minimum thickness of base (uncoated) metal, accurately positioned and secured behind at least 1 face-layer panel.
- D. Integrate stair hanger rods with gypsum board shaft wall assemblies by locating cavity of assemblies where required to enclose rods.
- E. At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons, elevator floor indicators, and similar items.
- F. Isolate gypsum finish panels from building structure to prevent cracking of finish panels while maintaining continuity of fire-rated construction.
- G. Install control joints to maintain fire-resistance rating of assemblies.
- H. Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly. Install acoustical sealant to withstand dislocation by air-pressure differential between shaft and external spaces; maintain an airtight and smoke-tight seal; and comply with manufacturer's written instructions or ASTM C 919, whichever is more stringent.
- I. In elevator shafts where gypsum board shaft wall assemblies cannot be positioned within 2 inches of the shaft face of structural beams, floor edges, and similar projections into shaft, install 1/2- or 5/8-inch- thick, gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
2. Where steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to the shaft wall framing.

#### 3.4 FINISHING GYPSUM BOARD SHAFT WALL ASSEMBLIES

- 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 those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: In accordance with finish level requirements in Section 09 21 13 – GYPSUM BOARD ASSEMBLIES.

#### 3.5 INSTALLING Identification for Fire- and Smoke-Partitions

- A. Marking and Identification for Fire- and Smoke-Partitions: Permanently install as required by Code.

#### 3.6 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or exhibit mold growth. Repair of damaged panels in place is not acceptable.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 09 30 00  
TILING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Floor tile.
  - 2. Wall tile.
  - 3. Stone thresholds installed as part of tile installations.
  - 4. Waterproofing and crack-suppression membrane for thin-set tile installations.
  - 5. Elastomeric sealants for expansion, contraction, control, and isolation joints in tile surfaces.
  - 6. Surface preparation for tile and accessories, inclusive of self-leveling underlayment.

1.2 DEFINITIONS

- A. Module Size: Actual tile size plus joint width indicated.
- B. Face Size: Actual tile size, excluding spacer lugs.

1.3 PERFORMANCE REQUIREMENTS

- A. Static Coefficient of Friction: For tile installed on walkway surfaces, provide products with the following values as determined by testing identical products per ASTM C 1028:
  - 1. Level Surfaces: Minimum 0.6.
  - 2. Step Treads: Minimum 0.6.
  - 3. Ramp Surfaces: Minimum 0.8.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Verification:
  - 1. Assembled samples with grouted joints for each type and composition of tile and for each color and finish required, at least 12 inches square and mounted on rigid panel. Use grout of type and in color or colors approved for completed work.
  - 2. Full-size units of each type of trim and accessory for each color and finish required.
  - 3. Stone thresholds in 6-inch lengths.
  - 4. Metal edge strips in 6-inch lengths.
- D. Qualification Data: For Installer.
- E. Material Test Reports: For each tile-setting and -grouting product.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Tile: Obtain all tile of same type and color or finish from one source or producer.
  - 1. Obtain tile from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from a single manufacturer and each aggregate from one source or producer.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section through one source from a single manufacturer for each product:
  - 1. Stone thresholds.
  - 2. Waterproofing.
  - 3. Joint sealants.
  - 4. Metal edge strips.
- D. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.
- E. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Conduct in-place layout meeting with Owner and Architect for each type of floor installation.
  - 2. Build mockup of each type of wall and floor tile installation. Minimum Size; 4 by 8 feet.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement in ANSI A137.1 for labeling sealed tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Store liquid additives in unopened containers and protected from freezing.

1.7 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1, "Specifications for Ceramic Tile," for types, compositions, and other characteristics indicated.



1. Provide tile complying with Standard grade requirements, unless otherwise indicated.
  2. For facial dimensions of tile, comply with requirements relating to tile sizes specified in Part 1 "Definitions" Article.
  3. Tile Dimensional Tolerance: 1/64 inch for variation in plane or in squareness.
  4. Large Format Tiles are defined as more than 8 inches in any nominal dimension.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI standards referenced in "Setting and Grouting Materials" Article.
- C. Factory Blending: For tile exhibiting color variations within ranges selected during Sample submittals, blend tile in factory and package so tile units taken from one package show same range in colors as those taken from other packages and match approved Samples.
- D. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer, unless otherwise indicated.
- E. Tile Trim Units: Matching characteristics of adjoining flat tile and coordinated with sizes and coursing of adjoining flat tile where applicable. Provide shapes selected from manufacturer's standard shapes.
- F. Metal Edge Strips: Angle or L-shape, height to match tile and setting-bed thickness, metallic or combination of metal and PVC or neoprene base, designed specifically for flooring applications; extruded aluminum exposed-edge material, with clear anodized satin finish.
1. Available Manufacturer: Schluter Systems.
- G. Slate Thresholds: complying with ASTM C 629, Classification II, Interior. Fabricate to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
1. Varieties and Cut: As selected by Architect.
  2. Finish: Honed, gauged back.
  3. Bevel edges at 1:2 slope, aligning lower edge of bevel with adjacent floor finish. Limit height of bevel to 1/2 inch or less, and finish bevel to match face of threshold.
  4. Threshold to meet minimum project accessibility guidelines.
- H. Fabric-Reinforced, Fluid-Applied Waterproofing and Crack Suppression Membrane: System consisting of liquid-latex rubber.
1. Custom Building Products; 9240 Waterproofing and Anti-Fracture Membrane with fabric reinforcing.
  2. LATICRETE International Inc.; Laticrete Hydroban Waterproof Membrane with fabric reinforcing.
  3. MAPEI Corporation; Aqua Defense with fabric reinforcing.
  4. Summitville Tiles, Inc.; S-9000 with fabric reinforcing.
- I. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- J. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
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. Bonsal American; an Oldcastle company.
    - b. Bostik, Inc.
    - c. Custom Building Products.

- d. Laticrete International, Inc.
  - e. MAPEI Corporation.
  - f. Summitville Tiles, Inc.
  - g. TEC; a subsidiary of H. B. Fuller Company.
  2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
  3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.
- K. Polymer-Modified Tile Grout: ANSI A118.7.
1. Polymer Type: Acrylic resin or styrene-butadiene rubber in liquid-latex form for addition to prepackaged dry-grout mix.
    - a. Unsanded grout mixture for joints 1/8 inch and narrower.
    - b. Sanded grout mixture for joints 1/8 inch and wider.
- L. 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.
- M. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints that does not change color or appearance of grout.

## 2.2 TILE PRODUCTS

- A. Ceramic Floor Tile: At toilet rooms.
1. Manufacturers: As indicated in finish schedule
  2. Module Size: As indicated in finish schedule
  1. Finish: Unpolished.
  2. Tile Color and Pattern: As indicated.
- B. Porcelain Floor Tile: Where indicated in Finish Schedule.
1. Basis-of-Design: As indicated in finish schedule
  2. Module Size: As indicated in finish schedule
  3. Base: 4 inch high, tile to match floor.
  4. Finish: Unpolished.
  5. Tile Color and Pattern: As indicated.
- C. Ceramic Wall Tile: At toilet rooms.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. American Olean
    - b. Crossville
    - c. Daltile
  2. Module Size: As selected by Architect.
  3. Base: 4 inch high, tile to match floor.
  4. Finish: Unpolished.
  5. Tile Color and Pattern: As indicated.

## 2.3 ELASTOMERIC SEALANTS

- A. General: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer and characteristics indicated. Comply with applicable requirements in Section 07 92 00 - JOINT SEALANTS.
- B. Colors: Provide colors of exposed sealants to match colors of grout in tile adjoining sealed joints, unless otherwise indicated.
- C. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.
  - 1. Available Products:
    - a. Custom Building Products; 100 Silicone Caulk.
    - b. Dow Corning Corporation; Dow Corning 786.
    - c. GE Silicones; Sanitary 1700.
    - d. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
    - e. Tremco, Inc.; Tremsil 600 White.
- D. Multipart, Pourable Urethane Sealant for Use T: ASTM C 920; Type M; Grade P; Class 25; Uses T, M, A, and, as applicable to joint substrates indicated, O.
  - 1. Available Products:
    - a. Bostik; Chem-Calk 550.
    - b. Tremco, Inc.; Vulkem 245.
    - c. Pecora Corporation; NR-200 Urexpan.
    - d. Tremco, Inc.; THC-900.

## 2.4 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. The Owner's Testing Agent will examine substrates and perform substrate alkalinity and adhesion testing; moisture testing; and relative humidity testing, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
  - 1. Verify that substrates for setting tile are firm; dry; clean; free of oil, waxy films, and curing compounds; and within flatness tolerances required by referenced ANSI A108 Series of tile installation standards for installations indicated.
  - 2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

3. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Concrete Substrates: Prepare according to ASTM F 710.
  1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring system.
  3. Moisture Vapor Emission Testing:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
  4. Relative Humidity Testing:
    - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
  5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- B. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.
- C. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
  1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
  2. Remove protrusions, bumps, and ridges by sanding or grinding.
- D. At areas where ceramic tile flooring is indicated for installation over moisture membrane, coordinate with the Work of Section 09 61 10 - VAPOR MITIGATION AT SLABS.
- E. Level concrete substrate with self-leveling concrete floor topping, installed in accordance with requirements of Section 03 54 00 - CONCRETE FLOOR TOPPING.
  1. Omit this requirement in locations where self-leveling underlayment is installed as part of water vapor mitigation system under the Work of Section 09 61 10 - VAPOR MITIGATION AT SLABS.
- F. Blending: For tile exhibiting color variations within ranges selected during Sample submittals, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

### 3.3 INSTALLATION, GENERAL

- A. ANSI Tile Installation Standards: Comply with parts of ANSI A108 Series "Specifications for Installation of Ceramic Tile" that apply to types of setting and grouting materials and to methods indicated in ceramic tile installation schedules.
- B. TCA Installation Guidelines: TCA's "Handbook for Ceramic Tile Installation." Comply with TCA installation methods indicated in ceramic tile installation schedules.
- C. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions, unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- E. Jointing Pattern: Lay tile in pattern indicated by Architect. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area to avoid tiles cut to less than half-size. 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.
- F. Lay out tile wainscots to next full tile beyond dimensions indicated.
- G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
  - 1. Locate joints in tile surfaces directly above joints in concrete substrates.
  - 2. Prepare joints and apply sealants to comply with requirements in Section 079200 - JOINT SEALANTS.
- H. Grout tile to comply with requirements of the following tile installation standards:
  - 1. For ceramic tile grouts (sand-portland cement; dry-set, commercial portland cement; and latex-portland cement grouts), comply with ANSI A108.10.

### 3.4 WATERPROOFING AND CRACK-SUPPRESSION MEMBRANE INSTALLATION

- A. Install waterproofing to comply with ANSI A108.13 and waterproofing manufacturer's written instructions to produce waterproof membrane of uniform thickness bonded securely to substrate.
- B. Install crack-suppression membrane to comply with manufacturer's written instructions to produce membrane of uniform thickness bonded securely to substrate.
- C. Do not install tile over waterproofing until membrane has cured and been inspected to determine that it is watertight.

### 3.5 FLOOR TILE INSTALLATION

- A. General: Install tile to comply with requirements in the Floor Tile Installation Schedule, including those referencing TCA installation methods and ANSI A108 Series of tile installation standards.
  - 1. For installations indicated below, follow procedures in ANSI A108 Series tile installation standards for providing 95 percent mortar coverage.
- B. Stone Thresholds: Install stone thresholds at locations indicated; set in same type of setting bed as abutting field tile, unless otherwise indicated; lap waterproofing membrane and provide continuous sealant bead. .
  - 1. Set thresholds in latex-portland cement mortar for locations where mortar bed would otherwise be exposed above adjacent nontile floor finish.
- C. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

### 3.6 WALL TILE INSTALLATION

- A. Install types of tile designated for wall installations to comply with requirements, including those referencing TCA installation methods and ANSI setting-bed standards.
  - 1. Large Format Wall Tile Installation: Comply with tile manufacturer's recommendations for setting beds and grouts.
    - a. Substrate Tolerances: Do not exceed 1/8 in. in 10 ft. and 1/16 in. in 2 ft.

### 3.7 CLEANING AND PROTECTING

- A. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
  - 1. Remove grout residue from tile as soon as possible.
  - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions, but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.
  - 3. Remove temporary protective coating by method recommended by coating manufacturer that is acceptable to tile and grout manufacturer. Trap and remove coating to prevent it from clogging drains.
- B. When recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
- C. Prohibit foot and wheel traffic from tiled floors for at least seven days after grouting is completed. After seven days, cover areas subject to construction traffic with heavy cardboard.
- D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

### 3.8 TILE INSTALLATION SCHEDULE

- A. This schedule refers to Tile Installation Methods specified in the TCNA Manual. Refer to Finish Schedule for Tile Product Types.

- B. Floor Tile PFT-1-3: Interior floor installation on concrete; thin-set mortar; TCA F113 and ANSI A108.5.
  - 1. Thin-Set Mortar: Latex-portland cement mortar.
  - 2. Grout: Polymer-modified unsanded grout.
  - 3. Joint Width: 1/8 inch.
  
- C. Floor Tile CT1: Interior floor installation on waterproof membrane over concrete; thin-set mortar; TCA F122 and ANSI A108.5.
  - 1. Thin-Set Mortar: Latex-portland cement mortar.
  - 2. Grout: Polymer-modified unsanded grout.
  - 3. Joint Width: 1/16 inch.
  
- D. Wall Tile Installation WT-1,2: Interior wall installation over cementitious backer units; thin-set mortar; TCA W244C and ANSI A108.5.
  - 1. Thin-Set Mortar: Latex-portland cement mortar.
  - 2. Grout: Polymer-modified unsanded grout.
  - 3. Joint Width: 1/16 inch.

END OF SECTION

SECTION 09 51 00  
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Acoustical ceiling tiles and panels.
  - 2. Suspension systems, grid systems and ceiling hangers.
  - 3. Acoustical sealant at edge moldings at acoustical ceilings.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
  - 1. Ceiling suspension members.
  - 2. Method of attaching hangers to building structure. Furnish layouts for cast-in-place anchors, clips, and other ceiling attachment devices whose installation is specified in other Sections.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 4. Minimum Drawing Scale: 1/4 inch = 1 foot.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
  - 1. Acoustical Tile and Panel: Set of 6 inch square Samples of each type, color, pattern, and texture.
  - 2. Exposed Suspension System Members, Moldings, and Trim: Set of 12 inch long Samples of each type, finish, and color.
- D. Asbestos Certification: Manufacturer's written certification that acoustical ceiling products contain no asbestos (0.0000%). Product labels indicating that it is the user's responsibility to test the products for asbestos are unacceptable and sufficient cause for rejection of the product on site.
- E. Maintenance Data: For finishes to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Source Limitations:
  - 1. Acoustical Ceiling Tiles and Panels: Obtain each type through one source from a single manufacturer.
  - 2. Suspension Systems: Obtain each type through one source from a single manufacturer.
- B. Seismic Performance:
  - 1. Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.



- C. Fire-Test-Response Characteristics: Provide acoustical tile and panel ceilings that comply with the following requirements:
  - 1. Fire-Resistance Characteristics: Where indicated, provide acoustical tile and panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
    - a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
    - b. Identify materials with appropriate markings of applicable testing and inspecting agency.
  - 2. Surface-Burning Characteristics: Provide acoustical tiles and panels complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
- D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.
  - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical tiles and panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork 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.
  - 1. The HVAC systems as specified elsewhere will not provide for humidity controls. The building will be air conditioned in summer months. The ranges of relative humidity are expected to be as high as 70% to an uncontrolled low during the heating season. Comply with AWS Section 2, Care and Storage.
  - 2. Contractor shall assume full responsibility for fabricating interior architectural woodwork to not deteriorate in the interior environment expected during occupancy, which is standard for the majority of new buildings designed and constructed .
    - a. Submission of bid shall represent acceptance of these terms.
    - b. Contrary manufacturer's and AWI disclaimers shall not apply if more restrictive than the conditions stated herein, as more stringent conditions are not typically provided in academic buildings.

1.6 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

PART 2 - PRODUCTS

2.1 ACOUSTICAL PANELS, GENERAL

- A. Products: Subject to compliance with specified requirements, provide one of the following products for each type indicated.
- B. ACT-1 and 2:
1. Manufacturer and Series:
    - a. USG, Mars ClimaPlus
    - b. Certainteed Ceilings, Symphony M.
    - c. Armstrong, Ultima
  2. Panel Sizes: 24 inches by 24 inches, 24 inches by 48 inches, 24 inches by 72 inches and 3/4 inches deep.
  3. Panel Mounting: Flat T edge for 15/16 inch wide grid. Basis-of-design; Armstrong
  4. Light Reflectance Value: Not less than 0.90.
  5. Noise Reduction Coefficient (NRC): Not less than 0.70.
  6. Ceiling Attenuation Class (CAC): Not less than 35.
  7. Color: White.
  8. Grid Material: Painted steel.
  9. Perimeter Molding:
    - a. Basis of Design: Armstrong Shadow Molding, or comparable product.

PART 3 - EXECUTION

3.1 METAL SUSPENSION SYSTEMS

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
1. Manufacturer: USG, Armstrong, Certainteed Ceilings, or Chicago Metallic.
  2. Structural Classification: Intermediate-duty system unless otherwise indicated.
  3. End Condition of Cross Runners: Override (stepped) or butt-edge type.
  4. Face Design: Flat, flush.
  5. Cap Material: Steel or aluminum cold-rolled sheet.
  6. Color: White, prefinished.
  7. Grid Face Width: As specified with ACT type.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
1. Anchors in Concrete: Anchors with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing per ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency; zinc-plated for Class SC1 service unless otherwise required.

2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190, conducted by a qualified testing and inspecting agency.
- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
1. Zinc-Coated Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
  2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106 diameter wire.
- D. Hold-Down Clips: At vestibules and areas subject to wind uplift, provide manufacturer's standard hold-down clips spaced 24 inches on all cross tees.

### 3.2 METAL EDGE MOLDINGS AND TRIM

- A. Roll-Formed Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that fit acoustical panel edge details and suspension systems indicated; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension system runners.
1. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member. Extend reveal edge all around room where edge is indicated or required to accommodate tile layout indicated.
  2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
  3. For narrow-face suspension systems, provide suspension system and manufacturer's standard edge moldings that match width and configuration of exposed runners.
- B. Suspension Trim: Subject to compliance with requirements, provide one of the following:
1. Armstrong World Industries, Inc.; Axiom.
  2. CertainTeed Ceilings; Approved equal.
  3. USG Interiors, Inc.; Compasso.

### 3.3 ACOUSTICAL SEALANT

- A. Acoustical Sealant for Concealed Joints: Manufacturer's standard nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant.

### 3.4 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.6 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
  - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by the most restrictive requirements of referenced standards and publications and as specified herein.
  - 4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
  - 5. 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.
  - 6. Do not attach hangers to steel deck tabs.
  - 7. Space hangers not more than 48 o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
  - 1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
  - 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
  - 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- 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 a neat, precise fit.
  - 1. Paint cut edges of tiles remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical tiles and panels manufacturer.

2. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings; space as recommended by panel manufacturer's written instructions, unless otherwise indicated.

3.7 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

SECTION 09 65 10  
RESILIENT FLOORING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Linoleum composition floor tile.
  - 2. Resilient wall base and accessories.
  - 3. Substrate preparation for resilient flooring and accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
  - 1. Show details of special patterns.
- C. Samples for Verification: Full-size units of each color and pattern of resilient floor tile required.
  - 1. Resilient Wall Base and Accessories: Manufacturer's standard-size Samples, but not less than 12 inches long, of each resilient product color and pattern required.
- D. Seam Samples for Sheet Flooring: For seamless-installation technique indicated and for each floor covering product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch sample applied to a rigid backing and prepared by Installer for this Project.
- E. Maintenance Data: For resilient products to include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide products identical to those tested for fire-exposure behavior per test method indicated by a testing and inspecting agency acceptable to authorities having jurisdiction.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store tiles on flat surfaces.

1.5 PROJECT CONDITIONS

- A. Maintain temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F in spaces to receive floor tile during the following time periods:
  - 1. 48 hours before installation.
  - 2. During installation.
  - 3. 48 hours after installation.
- B. After postinstallation period, maintain temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

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- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install resilient products after other finishing operations, including painting, have been completed.

**PART 2 - PRODUCTS**

**2.1 GENERAL**

**2.2 LUXURY VINYL TILE**

- A. Resilient Composition Floor Tile: ASTM F 2195.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Armstrong World Industries, Inc.
  - 2. Forbo Flooring, Inc.
  - 3. Tarkett Inc.
- C. Size: As indicated in the finish schedule
- D. Thickness: 0.080 inch.
- E. Colors: As selected by Architect from manufacturer's full line.

**2.3 RESILIENT WALL BASE**

- A. Wall Base: ASTM F 1861.
  - 1. Armstrong World Industries, Inc.
  - 2. Azrock Commercial Flooring, DOMCO
  - 3. Burke Mercer Flooring Products
  - 4. Johnsonite
  - 5. Marley Flexco (USA), Inc.(Basis-of-Design; Group 1, solid).
  - 6. Nora Rubber Flooring, Freudenberg Building Systems, Inc.
  - 7. Roppe Corporation
- B. Style and Colors: As selected by Architect from manufacturer's full line.
- C. Type (Material Requirement): TS (rubber, vulcanized thermoset) or TP (rubber, thermoplastic).
- D. Shape: Straight (toeless) at carpet and coved at resilient flooring.
- E. Minimum Thickness: 0.125 inch.
- F. Height: 4 inches.
- G. Lengths: Cut lengths 48 inches long or coils in manufacturer's standard length.
- H. Outside Corners: Premolded.
- I. Inside Corners: Premolded.

J. Surface: Smooth.

#### 2.4 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 manufacturer to suit resilient products and substrate conditions indicated.
- C. Sealant: Single-Component, Nonsag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT. Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Pecora Corporation; Dynatrol I-XL
  - 2. Sika Corporation, Construction Products Division; Sikaflex - 1a.
  - 3. Tremco Incorporated; Vulkem 116.
- D. Stair-Tread-Nose Filler: Two-part epoxy compound recommended by resilient tread manufacturer to fill nosing substrates that do not conform to tread contours.
- E. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.
- F. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. The Owner's Testing Agent will examine substrates and perform substrate alkalinity and adhesion testing; moisture testing; and relative humidity testing, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
  - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
  - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written recommendations to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturer. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring.
  - 3. Moisture Vapor Emission Testing:



- a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
  4. Relative Humidity Testing:
    - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
  5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- C. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
- D. Provide concrete substrates for tile floors that comply with flatness tolerances specified in referenced ANSI A108 Series of tile installation standards.
  1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by tile-setting material manufacturer.
  2. Remove protrusions, bumps, and ridges by sanding or grinding.
- E. At areas where resilient flooring is indicated for installation over moisture membrane, coordinate with the Work of Section 09 61 10 - VAPOR MITIGATION AT SLABS.
- F. Level concrete substrate with self-leveling concrete floor topping, installed in accordance with requirements of Section 03 54 00 - CONCRETE FLOOR TOPPING.
  1. Omit this requirement in locations where self-leveling underlayment is installed as part of water vapor mitigation system under the Work of Section 09 61 10 - VAPOR MITIGATION AT SLABS.
- G. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
  1. Do not install resilient products until they are same temperature as space where they are to be installed.
- H. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, and dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 TILE INSTALLATION

- A. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
  1. Lay tiles in pattern indicated.
- B. Match tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.

- C. Scribe, cut, and fit tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, doorframes, thresholds, and nosings.
- D. Extend tiles into toe spaces, door reveals, closets, and similar openings.
- E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- F. Install tiles on covers for telephone and electrical ducts and similar items in finished floor areas. Maintain overall continuity of color and pattern with pieces of tile installed on covers. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.
- G. Adhere tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

#### 3.4 RESILIENT WALL BASE INSTALLATION

- A. Apply wall base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- B. Install wall base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.
- C. Tightly adhere wall base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- D. Do not stretch wall base during installation.
- E. On masonry surfaces or other similar irregular substrates, fill voids along top edge of wall base with manufacturer's recommended adhesive filler material.
- F. Premolded Corners: Install premolded corners before installing straight pieces.

#### 3.5 RESILIENT ACCESSORY INSTALLATION

- A. Resilient Stair Accessories:
  - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
  - 2. Tightly adhere to substrates throughout length of each piece.
  - 3. For treads installed as separate, equal-length units, install to produce a flush joint between units.
- 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 coverings that would otherwise be exposed.

#### 3.6 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing resilient product installation:
  - 1. Remove adhesive and other blemishes from exposed surfaces.
  - 2. Sweep and vacuum surfaces thoroughly.
  - 3. Damp-mop surfaces to remove marks and soil.

- a. Do not wash surfaces until after time period recommended by manufacturer.
- B. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods recommended in writing by manufacturer.
  - 1. Apply protective floor polish to horizontal surfaces that are free from soil, visible adhesive, and surface blemishes if recommended in writing by manufacturer.
    - a. Coordinate selection of floor polish with the Owner's maintenance service.
  - 2. Cover products installed on horizontal surfaces with undyed, untreated building paper until Substantial Completion.
  - 3. Do not move heavy and sharp objects directly over surfaces. Place hardboard or plywood panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION

SECTION 09 68 10  
TILE CARPETING

PART 1 -GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
- 1 Modular carpet tile.
  - 2 Carpet accessories.
  - 3 Substrate preparation for carpet and accessories.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's written data on physical characteristics, durability, and fade resistance. Include installation recommendations for each type of substrate required.
- C. Shop Drawings: Show the following:
1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet.
  2. Carpet tile type, color, and dye lot.
  3. Type of subfloor.
  4. Type of installation.
  5. Pattern type, repeat size, location, direction, and starting point.
  6. Pile direction.
  7. Type, color, and location of insets and borders.
  8. Type, color, and location of edge, transition, and other accessory strips.
  9. Transition details to other flooring materials.
- D. 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.
- E. Product Schedule: For carpet tile. Use same designations indicated on Drawings.
- F. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
- 1 Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
  - 2 Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the Floor Covering Installation Board or who can demonstrate compliance with its certification program requirements.
- B. Fire-Test-Response Characteristics: Provide products with the critical radiant flux classification indicated in

Part 2, as determined by testing identical products per ASTM E 648 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

- C. Mockups: Before installing carpet tile, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
  - 1. Approved mockups may become part of the completed Work if undamaged at time of Substantial Completion.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104, Section 5, "Storage and Handling."

#### 1.6 PROJECT CONDITIONS

- A. Comply with CRI 104, Section 7, "Site Conditions."
- B. Environmental Limitations: Do not install carpet tiles until wet work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where equipment or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

#### 1.7 WARRANTY

- A. General Warranty: Special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and delamination.
  - 1. Warranty Period: Ten years from date of Substantial Completion.

### PART 2 -PRODUCTS

#### 2.1 CARPET TILE

#### 2.2 MANUFACTURERS

- A. Basis of Design (CPT): Refer to finish schedule on the Drawing sheets.

#### 2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.

### TILE CARPETING

- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
  - 1. VOC Limits: Provide adhesives with VOC content not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA method 24).

## PART 3 -EXECUTION

### 3.1 EXAMINATION

- A. The Owner's testing agent will examine substrates and perform substrate alkalinity and adhesion testing; moisture testing; and relative humidity testing, with Installer present, for compliance with requirements for installation tolerances, moisture content, and other conditions affecting performance.
- B. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
  - 1 Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by carpet tile manufacturer.
  - 2 Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with CRI 104, Section 7.3, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- B. Concrete Substrates: Prepare according to ASTM F 710.
  - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
  - 2. Alkalinity and Adhesion Testing: Perform tests recommended by flooring manufacturers. Proceed with installation only after substrate alkalinity falls within a range on pH scale not less than 5 or more than 9 pH, or as otherwise required in writing by manufacturer of flooring system.
  - 3. Moisture Vapor Emission Testing:
    - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours, or as otherwise required in writing by manufacturer of flooring.
  - 4. Relative Humidity Testing:
    - a. Perform relative humidity test, ASTM F 2170. Proceed with installation only after substrates have a maximum relative humidity level of 75 percent, or as otherwise required in writing by manufacturer of flooring.
  - 5. Perform tests indicated above and as recommended by flooring manufacturer. Proceed with installation only after substrates pass testing.
- C. Remove coatings, including curing compounds and other substances that contain soap, wax, oil, or silicone, that are incompatible with tile-setting materials.

- C. Provide concrete substrates for sheet carpet floors that comply with referenced standards.
  - 1. Fill cracks, holes, and depressions with trowelable leveling and patching compound according to tile-setting material manufacturer's written instructions. Use product specifically recommended by sheet carpet manufacturer.
  - 2. Remove protrusions, bumps, and ridges by sanding or grinding.
- D. At areas where sheet carpet flooring is indicated for installation over moisture membrane, coordinate with the Work of Section 09 61 10 - VAPOR MITIGATION AT SLABS.
- E. Level concrete substrate with self-leveling concrete floor topping, installed in accordance with requirements of Section 03 54 00 - CONCRETE FLOOR TOPPING.
  - 1. Omit this requirement in locations where self-leveling underlayment is installed as part of water vapor mitigation system under the Work of Section 09 61 10 - VAPOR MITIGATION AT SLABS.
- G. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates.
- H. Broom and vacuum clean substrates to be covered immediately before installing carpet. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 INSTALLATION

- A. General: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.
- B. Comply with carpet manufacturer's written recommendations for seam locations and direction of carpet; maintain uniformity of carpet direction, lay of pile, and tile staggering pattern.
- C. Installation Method: Partial glue down; install periodic tiles with releasable, pressure-sensitive adhesive.
- D. Maintain dye lot integrity. Do not mix dye lots in same area.
- 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 finish flooring 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, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
  - 2. Remove yarns that protrude from carpet tile surface.
  - 3. Vacuum carpet tile using commercial machine with face-beater element.

- B. Protect installed carpet tile to comply with CRI 104, Section 16, "Protection of Indoor Installations."
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION



SECTION 09 90 00  
PAINTING AND COATING

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
1. Field painting of exposed interior items and surfaces.
  2. Field painting of exposed exterior items and surfaces.
  3. Surface preparation for painting.

1.2 DEFINITIONS AND EXTENT

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
  3. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
  4. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.
- B. This Section includes surface preparation and field painting of exposed exterior and interior items and surfaces.
1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- C. Paint exposed surfaces, except where these Specifications indicate that the surface or material is not to be painted or is to remain natural. If an item or a surface is not specifically mentioned, paint the item or surface the same as similar adjacent materials or surfaces. If a color of finish is not indicated, Architect will provide custom colors and finishes to be matched.
1. Painting includes field painting of exposed surfaces in other than utility spaces, including but not limited to mechanical and electrical equipment that does not have a factory-applied final finish.
  2. In existing building, paint surfaces where work has occurred, matching existing color and sheen unless otherwise indicated. Paint entire room, with surface preparation so that patching is not discernable.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Prefinished items include the following factory-finished components:
    - a. Architectural woodwork.
    - b. Acoustical wall panels.
    - c. Toilet enclosures.
    - d. Lockers.
    - e. Elevator entrance doors and frames.
    - f. Elevator equipment.
    - g. Finished mechanical and electrical equipment.
    - h. Light fixtures.

2. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:
  - a. Foundation spaces.
  - b. Furred areas.
  - c. Ceiling plenums.
  - d. Pipe spaces.
  - e. Duct shafts.
  - f. Elevator shafts.
3. Finished metal surfaces include the following:
  - a. Anodized aluminum.
  - b. Stainless steel.
  - c. Chromium plate.
  - d. Copper and copper alloys.
  - e. Bronze and brass.
4. Operating parts include moving parts of operating equipment and the following:
  - a. Valve and damper operators.
  - b. Linkages.
  - c. Sensing devices.
  - d. Motor and fan shafts.
5. Labels: Do not paint over UL, FMG, or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.

### 1.3 SUBMITTALS

- A. Product Data: For each paint system indicated. Include block fillers and primers.
  1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.
    - a. Disclose material ingredients by name and Chemical Abstract Service (CAS) Registry Number.
  2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material.
- B. Samples for Verification: For each color and material to be applied, with texture to simulate actual conditions, on representative Samples of the actual substrate.
  1. Provide stepped Samples, defining each separate coat, including block fillers and primers. Use representative colors when preparing Samples for review. Resubmit until required sheen, color, and texture are achieved.
  2. Provide a list of materials and applications for each coat of each Sample. Label each Sample for location and application.
  3. Submit two eight inch by 12 inch Samples for each type of finish coating for Architect's review of color and texture only.
- C. Qualification Data: For Applicator.

### 1.4 QUALITY ASSURANCE

- A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

- B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.
- C. Mockups: Provide a full-coat benchmark finish sample for each type of coating and substrate required. Comply with procedures specified in PDCA P5. Duplicate finish of approved sample Submittals.
  - 1. Architect will select one room or surface to represent surfaces and conditions for application of each type of coating and substrate.
    - a. Wall Surfaces: Provide samples on at least 100 sq. ft.
    - b. Small Areas and Items: Architect will designate items or areas required.
  - 2. Apply benchmark samples, according to requirements for the completed Work, after permanent lighting and other environmental services have been activated. Provide required sheen, color, and texture on each surface.
    - a. After finishes are accepted, Architect will use the room or surface to evaluate coating systems of a similar nature.
  - 3. Final approval of colors will be from benchmark samples.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label and the following information:
  - 1. Product name or title of material.
  - 2. Product description (generic classification or binder type).
  - 3. Manufacturer's stock number and date of manufacture.
  - 4. Contents by volume, for pigment and vehicle constituents.
  - 5. Thinning instructions.
  - 6. Application instructions.
  - 7. Color name and number.
  - 8. VOC content.
- B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain storage containers in a clean condition, free of foreign materials and residue.
  - 1. Protect from freezing. Keep storage area neat and orderly. Remove oily rags and waste daily.

#### 1.6 PROJECT CONDITIONS

- A. Apply waterborne paints only when temperatures of surfaces to be painted and surrounding air are between 50 and 90 deg F.
- B. Apply solvent-thinned paints only when temperatures of surfaces to be painted and surrounding air are between 45 and 95 deg F.
- C. Do not apply paint in snow, rain, fog, or mist; or when relative humidity exceeds 85 percent; or at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.
  - 1. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by manufacturer during application and drying periods.

1.7 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Paint: Furnish four unopened gallons of each type of paint and coating work, in color and gloss as used for the Project.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work are listed in the Finish Schedule.

2.2 PAINT MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, and finish-coat materials that are compatible with one another and with the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
- B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.
  - 1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for paint application.
  - 1. Proceed with paint application only after unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.
  - 2. Start of painting will be construed as Applicator's acceptance of surfaces and conditions within a particular area.
- B. Coordination of Work: Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.
  - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others. Provide sealers or barrier coats and other means recommended by manufacturer, and conduct field testing.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved, and remove protection.
  
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
  
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions and technical bulletins for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and re-prime.
  - 2. Cementitious Materials: Prepare concrete, concrete unit masonry, cement plaster, and mineral-fiber-reinforced cement panel surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze. If hardeners or sealers have been used to improve curing, use mechanical methods of surface preparation.
    - a. Use abrasive blast-cleaning methods if recommended by paint manufacturer.
    - b. Determine alkalinity and moisture content of surfaces by performing appropriate tests. If surfaces are sufficiently alkaline to cause the finish paint to blister and burn, correct this condition before application. Do not paint surfaces if moisture content exceeds that permitted in manufacturer's written instructions.
    - c. Clean concrete floors to be painted with a 5 percent solution of muriatic acid or other etching cleaner. Flush the floor with clean water to remove acid, neutralize with ammonia, rinse, allow to dry, and vacuum before painting.
  - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and remove dust.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler in multiple coats to overcome shrinkage. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood, including doors, and cabinets, counters, cases, and paneling not having a factory-applied finish.
    - c. If transparent finish is required, backprime with spar varnish.
    - d. Backprime paneling on interior partitions where masonry, plaster, or other wet wall construction occurs on back side.
    - e. Seal tops, bottoms, and cutouts of unprimed wood doors with a heavy coat of varnish or sealer immediately on delivery.
  - 4. Ferrous Metals: Clean ungalvanized ferrous-metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with SSPC's recommendations.
    - a. Exterior Exposed Steel: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall

- exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
- b. Interior Exposed Steel, in Humid Environments: Clean steel surfaces in accordance with SSPC-SP 6/NACE No. 3 Commercial Blast Cleaning. Abrasive blast cleaned surfaces shall exhibit a uniform, angular profile of 1.5-3.0 mils. Prime cleaned surfaces within 8 hours and prior to surface rusting.
  - c. Interior Exposed Steel, in Dry Environments: Clean steel surfaces in accordance with SSPC-SP2 or SP3 Hand or Power Tool Cleaning.
5. Galvanized Surfaces: Clean galvanized surfaces in accordance with SSPC-SP16 Brush off Blast Cleaning of Galvanized Steel and NonFerrous Metals, to achieve a minimum 1 mil anchor profile.
- D. Material Preparation: Mix and prepare paint materials according to manufacturer's written instructions.
1. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.
  2. Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.
  3. Use only thinners approved by paint manufacturer and only within recommended limits.
- E. Tinting: Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

### 3.3 APPLICATION

- A. General: Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.
1. Paint colors, surface treatments, and finishes are indicated in the paint schedules.
  2. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable and consistent paint film.
  3. Provide finish coats that are compatible with primers used.
  4. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, grilles, convector covers, covers for finned-tube radiation, and similar components are in place. Extend coatings in these areas, as required, to maintain system integrity and provide desired protection.
  5. Paint surfaces behind movable equipment and furniture, and non-solid or glazed components, the same as similar exposed surfaces. Before final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
  6. Paint interior surfaces of ducts with a flat, nonspecular black paint where visible through registers or grilles.
  7. Paint backsides of access panels and removable or hinged covers to match exposed surfaces.
  8. Finish exterior doors and doors in wet areas on tops, bottoms, and side edges the same as exterior faces.
  9. Sand lightly between each succeeding enamel or varnish coat.
- B. Scheduling Painting: Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

1. The number of coats and film thickness required are the same regardless of application method. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.
  2. Omit primer over metal surfaces that have been shop primed and touchup painted.
  3. If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure that edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.
  4. Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, and does not deform or feel sticky under moderate thumb pressure, and until application of another coat of paint does not cause undercoat to lift or lose adhesion.
- C. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.
1. Brushes: Use brushes best suited for type of material applied. Use brush of appropriate size for surface or item being painted.
  2. Rollers: Use rollers of carpet, velvet-back, or high-pile sheep's wool as recommended by manufacturer for material and texture required.
  3. Spray Equipment: Use airless spray equipment with orifice size as recommended by manufacturer for material and texture required.
- D. Minimum Coating Thickness: Apply paint materials no thinner than manufacturer's recommended spreading rate to achieve dry film thickness indicated. Provide total dry film thickness of the entire system as recommended by manufacturer.
- E. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to items exposed in occupied spaces.
- F. Mechanical items to be painted include, but are not limited to, the following:
1. Uninsulated metal piping.
  2. Uninsulated plastic piping.
  3. Pipe hangers and supports.
  4. Tanks that do not have factory-applied final finishes.
  5. Visible portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets.
  6. Duct, equipment, and pipe insulation having "all-service jacket" or other paintable jacket material.
  7. Mechanical equipment that is indicated to have a factory-primed finish for field painting.
- G. Electrical items to be painted include, but are not limited to, the following:
1. Panelboards.
  2. Electrical equipment that is indicated to have a factory-primed finish for field painting.
- H. Block Fillers: Apply block fillers to concrete masonry block at a rate to ensure complete coverage with pores filled.
- I. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

- J. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.
- K. Transparent (Clear) Finishes: Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.
  - 1. Provide satin finish for final coats.
- L. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

### 3.4 FIELD QUALITY CONTROL

- A. The Owner reserves the right to invoke the following test procedure at any time and as often as the Owner deems necessary during the period when paint is being applied:
  - 1. The Owner may engage a qualified independent testing agency to sample paint material being used. Samples of material delivered to Project will be taken, identified, sealed, and certified in the presence of Contractor.
  - 2. Testing agency will perform appropriate tests for the following characteristics as required by the Architect.
  - 3. The Architect may direct Contractor to stop painting if test results show material being used does not comply with specified requirements. Contractor shall remove noncomplying paint from Project site, pay for testing, and repaint surfaces previously coated with the noncomplying paint. If necessary, Contractor may be required to remove noncomplying paint from previously painted surfaces if, on repainting with specified paint, the two coatings are incompatible.

### 3.5 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from Project site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping without scratching or damaging adjacent finished surfaces.

### 3.6 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage from painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. After completing painting operations, remove temporary protective wrappings provided by others to protect their work.
  - 1. After work of other trades is complete, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA P1.

### 3.7 PAINT SCHEDULE

- A. Schedule: Provide products and number of coats specified. Use of manufacturer's proprietary product names to designate colors, materials, generic class, standard of quality and performance criteria and is not intended to imply that products named are required to be used to the exclusion of equivalent performing products of other manufacturers.



B. Exterior Paint Schedule:

1. Exterior Ferrous Metal, Fluoropolymer System: Hi-Performance System. Finish: Metallic.
  - a. Surface Preparation: SSPC-SP6.
  - b. One Coat:
    - 1) Tnemec 90G-1K97 at 3.0 mils DFT; use for touch up.
    - 2) Dupont Ganicin Urethane Zinc Rich at 3.0 mils DFT.
    - 3) PPG Corafon ADS570 Zinc Rich Epoxy Primer at 3.0 mils DFT.
  - c. And One Coat:
    - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
    - 2) Dupont Imron HS at 3.0 mils DFT.
    - 3) PPG Pitthane HB Urethane 95-8800 at 3.0 mils DFT.
  - d. And One Coat:
    - 1) Tnemec 1070 Fluoronar at 2.0 mils DFT.
      - a) Finish: 1078 metallic, 1071 satin, or 1072 semi-gloss.
    - 2) Dupont Fluoropolymer at 3.0 mils DFT.
    - 3) PPG Corafon ADS Fluoropolymer at 1.5-2.0 mils DFT.
2. Exterior Galvanized Metal, Fluoropolymer System: Hi-Performance System. Finish: Metallic.
  - a. Surface Preparation: SSPC-SP16, Brush-Off Blast Cleaning for Non-Ferrous Metal.
  - b. One Coat:
    - 1) Tnemec 73 Endura-Shield at 3.0 mils DFT.
    - 2) Dupont Imron HS at 3.0 mils DFT.
    - 3) PPG Pitthane HB Urethane 95-8800 at 3.0 mils DFT.
  - c. And One Coat:
    - 1) Tnemec 1070 Fluoronar at 2.0 mils DFT.
      - a) Finish: 1078 metallic, 1071 satin, or 1072 semi-gloss.
    - 2) Dupont Fluoropolymer at 3.0 mils DFT.
    - 3) PPG Corafon ADS Fluoropolymer at 1.5-2.0 mils DFT.
3. Exterior Galvanized Metal Repair of AESS prior to Field-Finishing
  - a. Surface Preparation: SSPC-SP15, Commercial Power Tool Cleaning.
  - b. Coating: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20; as approved by manufacturer of finish-coat system.
    - 1) Apply to thickness matching adjacent galvanizing; applying in multiple coats if required.
  - c. Lightly sand intersection of galvanizing repair paint and shop-applied galvanizing to provide smooth transition between coatings.
4. Exterior Existing Prepainted Painted Steel, for Overcoat Painted Finish in Metallic:
  - a. Surface Preparation: Water Blast 5000 psi and SSPC-SP3 Power Tool Clean.
  - b. One Coat:
    - 1) Tnemec 394 Omnithane at 3.0 to 3.5 mils DFT.
    - 2) PPG PMC Amerlock 400 Hi-Build Epoxy at 3.0 to 4.0 mils DFT.
    - 3) RD Coatings Elasto Metal at 3.0 mils DFT.
    - 4) International Interplus 356 at 3.0 to 5.0 mils DFT.
  - c. And One Coat:
    - 1) Tnemec 66HS Hi-Build Epoxoline at 3.0 to 5.0 mils DFT.
    - 2) PPG PMC Amerlock 400 at 3.0 to 4.0 mils DFT.
    - 3) RD Coatings Elasto Metal at 7.0 mils DFT.
    - 4) International Intergard 475 HS at 5.0 to 10.0 mils DFT.
  - d. And One Coat:
    - 1) Tnemec 73 Endura-Shield at 3.0 to 5.0 mils DFT.

- 2) PPG PMC Amercoat 450H at 3.0 mils DFT.
- 3) RD Coatings MurCryl at 3.0 to 4.0 mils DFT.
- 4) International Interthane 990 HS at 3.0 to 4.0 mils DFT.

C. Interior Paint Schedule:

1. Interior Gypsum Wallboard and Plaster, Latex Paint Finish:
  - a. Two Coat, Primer: Tuff-Hide spray-applied primer/sealer provided under Section 092110 - GYPSUM BOARD ASSEMBLIES.
  - b. And Two Coats, Flat Finish: At ceilings, and elsewhere as indicated.
    - 1) Moore Eco Spec WB Interior Latex Flat 373.
    - 2) Duron Genesis Latex Flat.
    - 3) S-W ProMar 200 Zero-VOC Latex Flat.
    - 4) PPG Pure Performance Latex Eggshell.
    - 5) Glidden Professional Lifemaster No VOC Flat 9100.
    - 6) California Paint Envirotech Zero VOC Flat 633.
  - or
  - c. And Two Coats, Eggshell Finish: At walls, and elsewhere as indicated.
    - 1) Moore Eco Spec WB Interior Latex Eggshell 374.
    - 2) Duron Genesis Latex Eggshell.
    - 3) S-W ProMar 200 Zero-VOC Latex Eggshell.
    - 4) PPG Pure Performance Latex Eggshell.
    - 5) Glidden Professional Lifemaster No VOC Eggshell 9300.
    - 6) California Paint Envirotech Zero VOC Eggshell 631.
  - or
  - d. And Two Coats, Semi-Gloss Finish: At toilet rooms, other wet areas, and elsewhere as indicated.
    - 1) Moore Eco Spec WB Interior Latex Semi-Gloss 376.
    - 2) Duron Genesis Latex Semi-Gloss.
    - 3) S-W ProMar 200 Zero-VOC Latex Semi-Gloss.
    - 4) PPG Pure Performance Latex Semi-Gloss.
    - 5) Glidden Professional Lifemaster No VOC Semi-Gloss 9200.
    - 6) California Paint Envirotech Zero VOC Semi-Gloss 663.
2. Interior Gypsum Wallboard and Plaster at Laboratories, Toilet Rooms, and Other Wet Areas, Urethane Coating:
  - a. Surface Preparation: Cured, clean and dry, free of surface contaminants.
  - b. One Coat:
    - 1) Tnemec 201 Epoxoprime at 3.0- 4.0 mils DFT.
    - 2) PPG PMC Amerlock Sealer at 3.0 to 4.5 mils DFT.
    - 3) Dupont Hi-Solids Colar primer at 3.0 to 4.0 mils DFT.
    - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
  - c. And One Coat:
    - 1) Tnemec 280 Tneme-glaze at 6.0 to 8.0 mils DFT.
    - 2) PPG PMC Amercoat 351 Epoxy at 6.0 to 8.0 mils DFT.
    - 3) Dupont 100 % Solids Epoxy at 8.0-10.0 mils.
    - 4) International Interseal 670 HS at 3.0 to 4.0 mils DFT.
  - d. And One Coat:
    - 1) Tnemec 1080 or 1081 Endurashield WB at 3.0 to 3.5 mils DFT.
    - 2) PPG PMC AmerShield VOC at 2.0 to 3.0 mils DFT.
    - 3) Dupont WB Urethane at 3.5 to 4.0 mils DFT.
    - 4) International Water Borne Urethane at 3.0 to 4.0 mils DFT.
3. Interior Metals (Not specified to receive other coating systems/not shop finished), Epoxy Painted Finish:

- a. One Coat: Approved primer, in shop under other Sections (where specified). If not shop primed, provide primer recommended by finish coating manufacturer.
  - b. And One Coat:
    - 1) Tnemec 1029 Enduratone at 2.0 mils DFT.
    - 2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
    - 3) Dupont 25P at 3.0 to 4.0 mils DFT.
    - 4) International Interseal 670 HS at 3.0 mils DFT.
  - c. And One Coat:
    - 1) Tnemec 1029 Enduratone at 2.0 to 3.0 mils DFT.
    - 2) PPG PMC Amerlock 400 at 2.0 to 4.0 mils DFT.
    - 3) Dupont High Solids Acrylic Coating 3.0 mils DFT.
    - 4) International Intercryl 530 at 3.0 to 4.0 mils DFT.
4. Interior Exposed Steel, Joists, Ductwork, Conduit and Similar Items (where indicated), Dry-Fall or Dry-Fog Painted System:
- a. One Coat:
    - 1) Tnemec 115 WB Unibond at 2.5 to 3.0 mils DFT.
    - 2) PPG PMC Amercoat 220 Acrylic at 3.0 mils DFT.
    - 3) International Intercryl 530 at 2.5 to 3.0 mils DFT.
    - 4) RD Coatings Muracryl at 2.0 to 3.0 mils DFT.
5. Epoxy Floor Paint System: Where indicated in Finish Schedule.
- a. One Coat:
    - 1) Tnemec 201 Epoxoprime at 4.0 to 6.0 mils DFT.
    - 2) Dex-O-Tex C Bond Coat at 6.0-7.0 mils DFT.
    - 3) RD Coatings Unifix at 2.0 mils DFT.
  - b. And One Coat:
    - 1) Tnemec 206 Flexible Epoxy Underlayment at 30 to 50 mils DFT.
    - 2) Dex-O-Tex Cheminert SC Membrane at 70-80 mils DFT.
    - 3) RD Coatings Elasto Deck at 50-80 mils DFT.
  - c. And One Coat:
    - 1) Tnemec 297 at 3.0 mils DFT.
    - 2) Dex-O-Tex Quik-Glaze at 7.0-8.0 mils DFT.
    - 3) RD Coatings Muracryl at 3.0 mils DFT.
6. Mechanical and Electrical Work: Paint all exposed items throughout the project except factory finished items with factory-applied baked enamel finishes which occur in mechanical rooms or areas, and excepting chrome or nickel plating, stainless steel, and aluminum other than mill finished. Paint all exposed ductwork and inner portion of all ductwork same as specified for other interior metals, hereinabove.

END OF SECTION

SECTION 10 11 00  
VISUAL DISPLAY SURFACES

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. Work Included: The Work of this Section includes, but is not limited to the following:
  - 1. Magnetic glass marker-boards.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, include construction details, material descriptions, dimensions of individual components and profiles, and finishes for visual display surfaces.
- B. Shop Drawings: For visual display surfaces. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Show locations of panel joints.
  - 2. Include sections of typical trim members.
- C. Samples for Verification: For each type of visual display surface indicated.
  - 1. Visual Display Surface: Not less than 8-1/2 by 11 inches, actual section of glass Marker-board, including frame.
  - 2. Trim: 6-inch long sections of each trim profile.
  - 3. Accessories: Full-size Sample of each type of accessory.
- D. Maintenance Data: Submit manufacturer's maintenance instructions or recommendations for metal storage shelving to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of motor-operated, sliding visual display units required for this Project.
- B. Source Limitations: Obtain visual display surfaces from single source from single manufacturer.
- C. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate appearance and aesthetic effects and set quality standards for installation.

1. Build mockup of typical wall area as shown on Drawings. Include accessories.
  2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- D. Pre-installation Conference: Conduct conference at Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver factory-built visual display surfaces, including factory-applied trim where indicated, completely assembled in one piece without joints, where possible. If dimensions exceed maximum manufactured panel size, provide two or more pieces of equal length as acceptable to Architect. When overall dimensions require delivery in separate units, pre-fit components at the factory, disassemble for delivery, and make final joints at the site.
- B. Store visual display surfaces vertically with packing materials between each unit.

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings.

#### 1.7 WARRANTY

- A. Special Warranty for Porcelain-Enamel Face Sheets: Manufacturer's standard form in which manufacturer agrees to repair or replace porcelain-enamel face sheets that fail in materials or workmanship within manufacturer's specified warranty period.

### PART 2 - PRODUCTS

#### 2.1 MAGNETIC GLASS MARKER-BOARDS

- A. Basis of Design: Subject to compliance with requirements, provide Magnetic Glass Dry Erase Marker Boards as manufactured by Bendheim, or approved equal from one of the following:
  1. Forms + Surfaces.
  2. High Tower.
- B. Magnetic Marker boards: Intended for use with dry-erase markers and magnetic aids and consisting of 5/16 inch laminated glass, complying with ANSI Z97.1 and CPSC standard 16 CFR 1201 Category II.
  1. Color: To match Architect's approved sample.
  2. Glass Edges: Mitered; butt joints.
- C. Adhesive: Mildew-resistant, non-staining, adhesive, for use with specific wall covering and substrate application, as recommended in writing by wall covering manufacturer.

## 2.2 STANDARD MARKERBOARDS

- A. Basis of design product to be PolyVision Ceramicsteel, Satin Low Gloss, Color White #6100S, or equivalent.

## 2.3 MARKERBOARD ACCESSORIES

- A. Aluminum Frames and Trim: Fabricated from not less than 0.062-inch thick, extruded aluminum; of size and shape indicated on Drawings.
  - 1. Field-Applied Trim: Snap-on trim with no visible screws or exposed joints
- B. Aluminum Framing/Glazing Channels: Provide top and bottom channels fabricated from aluminum sheet/plate; designed to frame and support magnetic marker boards; complying with ASTM B 209, Alloy 6061; secured to base building structure at locations, depths, thickness and profiles indicated.
  - 1. Dimensions: As indicated.
  - 2. Finish and Color: Powder coated; white to match Architect's approved samples, unless otherwise indicated.

## 2.4 FABRICATION

- A. Factory-Assembled Visual Display Units: Coordinate factory-assembled units with trim and accessories indicated. Join parts with a neat, precision fit.
  - 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with minimum number of joints.
  - 2. Provide manufacturer's standard mullion trim at joints between marker boards and Tack boards of combination units.
  - 3. Where size of visual display boards or other conditions require support in addition to normal trim, provide structural supports or modify trim as indicated or as selected by Architect from manufacturer's standard structural support accessories to suit conditions indicated.
- B. Aluminum Frames and Trim: Fabricate units straight and of single lengths, keeping joints to a minimum. Miter corners to a neat, hairline closure.
  - 1. Where factory-applied trim is indicated, trim shall be assembled and attached to visual display units at manufacturer's factory before shipment.

## 2.5 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. 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.

## 2.6 ALUMINUM FINISHES

- A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances, surface conditions of wall, and other conditions affecting performance of the Work.
- B. Examine roughing-in for electrical power systems to verify actual locations of connections before installation of motor-operated, sliding visual display units.
- C. Examine walls and partitions for proper preparation and backing for visual display surfaces.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Comply with manufacturer's written instructions for surface preparation.
- B. Clean substrates of substances that could impair the performance of and affect the smooth, finished surfaces of visual display boards, including dirt, mold, and mildew.
- C. Prepare surfaces to achieve a smooth, dry, clean surface free of flaking, unsound coatings, cracks, defects, projections, depressions, and substances that will impair bond between visual display surfaces and wall surfaces.

### 3.3 INSTALLATION, GENERAL

- A. General: Install visual display surfaces in locations and at mounting heights indicated on Drawings, or if not indicated, at heights indicated below. Keep perimeter lines straight, level, and plumb. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for complete installation.

### 3.4 INSTALLATION OF VISUAL DISPLAY BOARDS AND ASSEMBLIES

- A. Fastener Method: Attach concealed clips, hangers, and grounds to wall surfaces and to visual display boards with fasteners at not more than 16 inches o.c. Secure both top and bottom of boards to walls.
  - 1. Locations: As indicated on the Drawings.

### 3.5 CLEANING AND PROTECTION

- A. Clean visual display surfaces according to manufacturer's written instructions. Attach one cleaning label to visual display surface in each room.
- B. Touch up factory-applied finishes to restore damaged or soiled areas.
- C. Cover and protect visual display surfaces after installation and cleaning.

END OF SECTION



SECTION 10 14 00  
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Interior panel signage other than illuminated exit signs, including but not limited to, accessibility signage, toilet room signage, way-finding signage and room signage.
  - 2. Exterior signage mounted to building façade.

1.2 COORDINATION

- A. Coordinate with Owner's Campus Architect for campus requirements for code-required signage and Owner-provided wayfinding signage.

1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of sign.
- B. Shop Drawings: Include plans, elevations, and large-scale sections of typical members and other components. Show mounting methods, grounds, mounting heights, layout, spacing, reinforcement, accessories, and installation details.
  - 1. Provide message list for each sign, including large-scale details of wording, lettering, artwork, and braille layout.
- C. Samples for Verification: For each type of sign, include the following Samples to verify color selected:
  - 1. Panel Signs: Full-size Samples of each type of sign required.
  - 2. Approved samples will not be returned for installation into Project.
- D. Mounting: product data for attachment of interior signs, and details with templates for anchoring of exterior signs.
- E. Maintenance Data: For signage cleaning and maintenance requirements to include in maintenance manuals.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain each sign type through one source from a single manufacturer.
- B. Regulatory Requirements: Comply with applicable provisions of applicable codes and regulations, including but not limited to ICC A117.1 and the Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG).

1.5 PROJECT CONDITIONS

- A. Field Measurements: Where sizes of signs are determined by dimensions of surfaces on which they are installed, verify dimensions by field measurement before fabrication and indicate measurements with sign locations on Shop Drawings.

1.6 COORDINATION

- A. For signs supported by or anchored to permanent construction, advise installers of anchorage devices about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

PART 2 - PRODUCTS

2.1 PANEL SIGNS

- A. General: Provide signs that comply with requirements indicated for materials, thicknesses, finishes, colors, designs, shapes, sizes, and details of construction as indicated. Produce smooth panel sign surfaces constructed to remain flat under installed conditions within tolerance of plus or minus 1/16 inch measured diagonally. Provide the following:
  - 1. Code-Required Signs for Certificate of Occupancy:
    - a. Type: Photopolymer on acrylic or printed acrylic / aluminum as applicable.
    - b. Color: Custom color as selected.
    - c. Type Size: As selected.
    - d. Typeface: As selected.
- B. Tactile and Braille Copy: Manufacturer's standard process for producing copy complying with ADA Accessibility Guidelines and ICC/ANSI A117.1. Text shall be accompanied by Grade 2 braille. Produce precisely formed characters with square cut edges free from burrs and cut marks.
  - 1. Raised-Copy Thickness: Not less than 1/32 inch and as otherwise required.
- C. Symbols of Accessibility: Provide 6-inch-high symbol fabricated from opaque nonreflective vinyl film, 0.0035-inch nominal thickness, with pressure-sensitive adhesive backing suitable for both exterior and interior applications.

2.2 EXTERIOR WALL SIGNAGE

- A. General: Fabricated or cast aluminum painted letters and non-illuminated.
- B. Materials:
  - 1. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
  - 2. Aluminum Sheet and Plate: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
  - 3. Aluminum Extrusions: ASTM B 221 (ASTM B 221M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
  - 4. Fasteners: Concealed, stainless steel.
  - 5. Sign Mounting Fasteners - Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.

6. Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
7. Finish: custom color as determined by Architect.

### 2.3 ACCESSORIES

- A. Mounting Methods: Use double-sided vinyl tape fabricated from materials that are not corrosive to sign material and mounting surface.
- B. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed stainless steel or lead expansion-bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work. Coordinate appropriate anchorage methods with provider of other wall materials, and furnish appropriate anchorage devices.

## 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 work.
- B. Verify that items installed under other sections of Work are sized and located to accurately accommodate signs.
- C. Examine supporting members to ensure that surfaces are at elevations indicated or required to comply with authorities having jurisdiction and are free from dirt and other deleterious matter.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General: Locate signs and accessories where indicated, using mounting methods of types described and in compliance with manufacturer's written instructions.
  1. Install signs level, plumb, and at heights indicated, with sign surfaces free from distortion and other defects in appearance.
  2. Interior Wall Signs: Install signs on walls adjacent to latch side of door where applicable. Where not indicated or possible, such as double doors, install signs on nearest adjacent walls. Locate to allow approach within 3 inches of sign without encountering protruding objects or standing within swing of door.
- B. Wall-Mounted Panel Signs: Attach panel signs to wall surfaces using methods indicated below:
  1. Vinyl-Tape Mounting: Use double-sided foam tape to mount signs to smooth, nonporous surfaces. Do not use this method for vinyl-covered or rough surfaces.

### 3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by the Architect.

END OF SECTION

SECTION 10 21 13  
TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SUMMARY

- A. Provide floor mounted phenolic toilet compartments.
- B. Provide wall-hung phenolic urinal screens.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.
- C. Samples: Submit color selection samples, and two representative samples of each material specified indicating visual characteristics and finish. Include range samples if variation of finish is anticipated.

1.3 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

1.4 COORDINATION

- A. Coordinate with providers of metal fabrications for location and attachment of toilet compartments to support assemblies.
- B. Coordinate with provider of toilet accessories for accommodation of accessories in toilet compartments; comply with ADA standards.
- C. Coordinate with provider of gypsum board assemblies for blocking requirements before enclosure.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Toilet Compartments:
  - 1. Manufacturers: American Sanitary Partition Corporation, Bradley Corporation, or approved equal.
  - 2. Style:
  - 3. Screens: Wall-hung.
  - 4. Materials:
    - a. Phenolic core assembly, ¾" thick minimum.
    - b. Fittings and finish: Stainless steel #4 brushed.
    - c. Lift-free emergency access keepers.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- B. Limit openings between panels, doors and pilasters to less than 1/2".
- C. Adjust hardware, clean, and protect work.

END OF SECTION

SECTION 10 28 13  
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide toilet and sink accessories.

1.2 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.
- B. Shop Drawings: Submit shop drawings indicating material characteristics, details of construction, connections, and relationship with adjacent construction.

2.2 QUALITY ASSURANCE

- A. Comply with governing codes and regulations. Mount in accordance with ADA standards. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

- 2. - PRODUCTS

- a. MATERIALS

- i. Refer to schedule listed on the drawings.

- 3. - EXECUTION

- a. INSTALLATION

- i. Coordinate with toilet compartment provider.
        - ii. Install materials and systems in accordance with manufacturer's instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
        - iii. Restore damaged finishes and test for proper operation. Clean and protect work from damage until Substantial Completion.

END OF SECTION

SECTION 10 44 00  
FIRE-PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section, including but not limited to the following:
  - 1. Portable fire extinguishers.
  - 2. Fire-protection cabinets for portable fire extinguishers.
  - 3. Mounting brackets for fire extinguishers.

1.2 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each item.
  - 1. Fire Extinguishers: Include rating and classification.
  - 2. Fire-Protection Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Maintenance Data: For fire extinguishers and fire-protection cabinets to be include in maintenance manuals.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and fire-protection cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.
- D. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements of ASTM E 814 to maintain fire-resistance rating of walls where they are installed.

1.4 COORDINATION

- A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.
- B. Coordinate fire-rating of fire extinguisher cabinets with fire-rated partitions to ensure partition fire-rating is maintained.

PART 2 - PRODUCTS

2.1 GENERAL

2.2 PORTABLE FIRE EXTINGUISHERS

- A. General: Provide fire extinguishers of type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
- B. Multipurpose Dry-Chemical Type in Steel Container: UL-rated multi-purpose, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 FIRE-PROTECTION CABINET

- A. Basis-of-Design: Subject to compliance with requirements, provide Potter Roemer "Alta", fire-rated where required, or comparable product from one of the following:
  - 1. JL Industries, Inc.
  - 2. Larsen's Manufacturing Company.
  - 3. Potter Roemer; Div. of Smith Industries, Inc.
- B. Cabinet Type: Suitable for fire extinguisher size and type.
- C. Cabinet Material: Stainless steel door and frame with #4 brushed finish; 22 ga. steel box.
- D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated.
  - 1. Trimless Style: One-piece door frame overlapping cabinet frame, concealed frame lapping surrounding wall surface with back-bent wall return at outer edge.
- E. Door Material: 304 stainless steel with brushed finish.
- F. Door Style: Duo vertical panel with lock and break-glass handle; tempered safety glass complying with ANSI Z97-1-1984..
- G. Door Hardware: Manufacturer's standard, ADA-compliant, door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
- H. 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 by Architect.

2.4 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
  - 1. Provide at service area and mechanical spaces.



- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

## 2.5 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. Construct fire-rated cabinets with double walls fabricated from 0.0428-inch-thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material.
    - a. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
  - 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.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

## 2.6 FINISHES, GENERAL

- 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. Finish fire-protection cabinets after assembly.
- D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other 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 recessed cabinets will be installed.
- B. Examine fire extinguishers for proper charging and tagging. Contractor shall be responsible for fire extinguisher tagging by a certified service technician located within 75 miles of the project.
  - 1. Remove and replace damaged, defective, or undercharged units.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire-protection specialties in locations and at mounting heights indicated on the Drawings and acceptable to authorities having jurisdiction.
- B. Fire-Protection Cabinets: Fasten fire-protection cabinets to structure, square and plumb.
  - 1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire-protection cabinets.
  - 2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
- C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
- D. Identification: Apply required signage at locations indicated.

3.4 INSTALLATION OF FIRE-RATED CABINETS

- A. Seal through penetrations with firestopping sealant as specified in Section 07 84 00 - FIRESTOPPING.

3.5 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, as fire-protection specialties 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 and break-glass 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 manufacturer.

END OF SECTION

SECTION 21 05 17  
SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  - 2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls below Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 2. Concrete Slabs-on-Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs above Grade:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
  - 4. Interior Partitions:
    - a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.

END OF SECTION

SECTION 21 05 18  
ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- B. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- C. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - c. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - d. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - e. Bare Piping in Equipment Rooms: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 21 05 23  
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION 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. Two-piece ball valves with indicators.
  - 2. Bronze butterfly valves with indicators.
  - 3. Iron butterfly valves with indicators.
  - 4. Check valves.
  - 5. Bronze OS&Y gate valves.
  - 6. Iron OS&Y gate valves.
  - 7. NRS gate valves.
  - 8. Trim and drain valves.

1.3 DEFINITIONS

- A. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- B. NRS: Nonrising stem.
- C. OS&Y: Outside screw and yoke.
- D. SBR: Styrene-butadiene rubber.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, and weld ends.
  - 3. Set valves open to minimize exposure of functional surfaces.



- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
  - 1. Main Level: HAMV - Fire Main Equipment.
    - a. Level 1: HLOT - Valves.
      - 1) Level 3: HLUG - Ball Valves, System Control.
      - 2) Level 3: HLXS - Butterfly Valves.
      - 3) Level 3: HMER - Check Valves.
      - 4) Level 3: HMRZ - Gate Valves.
  - 2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    - a. Level 1: VQGU - Valves, Trim and Drain.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
  - 1. Automated Sprinkler Systems:
    - a. Valves.
      - 1) Gate valves.
      - 2) Check valves.
        - a) Single check valves.
      - 3) Miscellaneous valves.
- C. Source Limitations for Valves: Obtain valves for each valve type from single manufacturer.
- D. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
  2. ASME B1.20.1 for threads for threaded-end valves.
  3. ASME B31.9 for building services piping valves.
- E. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- F. NFPA Compliance: Comply with NFPA 24 for valves.
- G. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher as required by system pressures.
- H. Valve Sizes: Same as upstream piping unless otherwise indicated.
- I. Valve Actuator Types:
1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
  2. Handwheel: For other than quarter-turn trim and drain valves.
  3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

## 2.2 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Description:
1. UL 1091, except with ball instead of disc and FM Global standard for indicating valves (butterfly or ball type), Class Number 1112.
  2. Minimum Pressure Rating: 175 psig.
  3. Body Design: Two piece.
  4. Body Material: Forged brass or bronze.
  5. Port Size: Full or standard.
  6. Seats: PTFE.
  7. Stem: Bronze or stainless steel.
  8. Ball: Chrome-plated brass.
  9. Actuator: Worm gear or traveling nut.
  10. Supervisory Switch: Internal or external.
  11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
  12. End Connections for Valves NPS 2-1/2: Grooved ends.

## 2.3 BRONZE BUTTERFLY VALVES WITH INDICATORS

- A. Description:
1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 1112.
  2. Minimum: Pressure rating: 175 psig.
  3. Body Material: Bronze.
  4. Seat Material: EPDM.
  5. Stem Material: Bronze or stainless steel.
  6. Disc: [Bronze] [Stainless steel][ with EPDM coating].

7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Ends Connections for Valves NPS 1 through NPS 2: Threaded ends.
10. Ends Connections for Valves NPS 2-1/2: Grooved ends.

#### 2.4 IRON BUTTERFLY VALVES WITH INDICATORS

A. Description:

1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
4. Seat Material: EPDM.
5. Stem: Stainless steel.
6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
7. Actuator: Worm gear or traveling nut.
8. Supervisory Switch: Internal or external.
9. Body Design: Lug or wafer, Grooved-end connections.

#### 2.5 CHECK VALVES

A. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

#### 2.6 BRONZE OS&Y GATE VALVES

A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Bronze or brass.
4. Wedge: One-piece bronze or brass.
5. Wedge Seat: Bronze.
6. Stem: Bronze or brass.
7. Packing: Non-asbestos PTFE.

8. Supervisory Switch: External.
9. End Connections: Threaded.

## 2.7 IRON OS&Y GATE VALVES

### A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged, Grooved, or Threaded.

## 2.8 NRS GATE VALVES

### A. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged, Grooved, or Threaded.

## 2.9 TRIM AND DRAIN VALVES

### A. Ball Valves:

1. Description:
  - a. Pressure Rating: 175 psig.
  - b. Body Design: Two piece.
  - c. Body Material: Forged brass or bronze.
  - d. Port size: Full or standard.
  - e. Seats: PTFE.
  - f. Stem: Bronze or stainless steel.
  - g. Ball: Chrome-plated brass.
  - h. Actuator: Handlever.
  - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
  - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.

- B. Angle Valves:
  - 1. Description:
    - a. Pressure Rating: 175 psig.
    - b. Body Material: Brass or bronze.
    - c. Ends: Threaded.
    - d. Stem: Bronze.
    - e. Disc: Bronze.
    - f. Packing: Asbestos free.
    - g. Handwheel: Malleable iron, bronze, or aluminum.
  
- C. Globe Valves:
  - 1. Description:
    - a. Pressure Rating: 175 psig.
    - b. Body Material: Bronze with integral seat and screw-in bonnet.
    - c. Ends: Threaded.
    - d. Stem: Bronze.
    - e. Disc Holder and Nut: Bronze.
    - f. Disc Seat: Nitrile.
    - g. Packing: Asbestos free.
    - h. Handwheel: Malleable iron, bronze, or aluminum.

### 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 GENERAL REQUIREMENTS FOR VALVE INSTALLATION

- A. Comply with requirements in the following Sections for specific valve installation requirements and applications:
  - 1. Section 211313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.

- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 210553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.
- H. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply except from fire-department connections.
- I. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

END OF SECTION

SECTION 21 13 13  
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Specialty valves.
  - 3. Sprinklers.
  - 4. Alarm devices.
  - 5. Pressure gages.
- B. Related Requirements:
  - 1. Section 230523 "General-Duty Valves for Water-Based Fire-Suppression Piping".

1.3 DEFINITIONS

- A. High-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure higher than standard 175 psig, but not higher than 250 psig.
- B. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For wet-pipe sprinkler systems.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. HVAC hydronic piping.
  - 3. Items penetrating finished ceiling include the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
- B. Qualification Data: For qualified Installer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:



1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
  - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

#### 1.9 FIELD CONDITIONS

- A. Interruption of Existing Sprinkler Service: Do not interrupt sprinkler service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary sprinkler service according to requirements indicated:
  1. Notify Architect no fewer than two days in advance of proposed interruption of sprinkler service.
  2. Do not proceed with interruption of sprinkler service without Architect's written permission.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  1. NFPA 13.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design wet-pipe sprinkler systems.
  1. Sprinkler system design shall be approved by authorities having jurisdiction.
    - a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    - b. Sprinkler Occupancy Hazard Classifications:
      - 1) Building Service Areas: Ordinary Hazard, Group 1.
      - 2) Electrical Equipment Rooms: Ordinary Hazard, Group 1
      - 3) General Storage Areas: Ordinary Hazard, Group 1
      - 4) Laundries: Ordinary Hazard, Group 1
      - 5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1
      - 6) Office and Public Areas: Light Hazard
      - 7) Restaurant Service Areas: Ordinary Hazard, Group 1

2. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft area.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft area.
  3. Maximum Protection Area per Sprinkler: According to UL listing.
  4. Maximum Protection Area per Sprinkler:
    - a. Office Spaces: 225 sq. ft..
    - b. Storage Areas: 130 sq. ft.
    - c. Mechanical Equipment Rooms: 130 sq. ft.
    - d. Electrical Equipment Rooms: 130 sq. ft.
    - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.

## 2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; or ASME B36.10M wrought steel, with wall thickness not less than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.
- D. Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick, ASME B16.21, nonmetallic and asbestos free, or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
  2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
  1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
  1. Pressure Rating: 175-psig minimum.

2. Painted or Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

### 2.3 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" and FM Global's "Approval Guide."
- B. Pressure Rating:
  1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
  1. Standard: UL 193.
  2. Design: For horizontal or vertical installation.
  3. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages,[ retarding chamber,] and fill-line attachment with strainer.
  4. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
  5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
  6. 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.
- G. Automatic (Ball Drip) Drain Valves:
  1. Standard: UL 1726.
  2. Pressure Rating: 175-psig minimum.
  3. Type: Automatic draining, ball check.
  4. Size: NPS 3/4.
  5. End Connections: Threaded.

### 2.4 SPRINKLER PIPING SPECIALTIES

- A. Listed in UL's "Fire Protection Equipment Directory" and FM Global's "Approval Guide."
- B. Branch Outlet Fittings:
  1. Standard: UL 213.
  2. Pressure Rating: 175-psig minimum.
  3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  4. Type: Mechanical-tee and -cross fittings.
  5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.

6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- C. Flow Detection and Test Assemblies:
1. Standard: UL's "Fire Protection Equipment Directory" and FM Global's "Approval Guide."
  2. Pressure Rating: 175-psig minimum.
  3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded or grooved.
- D. Branch Line Testers:
1. Standard: UL 199.
  2. Pressure Rating: 175 psig.
  3. Body Material: Brass.
  4. Size: Same as connected piping.
  5. Inlet: Threaded.
  6. Drain Outlet: Threaded and capped.
  7. Branch Outlet: Threaded, for sprinkler.
- E. Sprinkler Inspector's Test Fittings:
1. Standard: UL's "Fire Protection Equipment Directory" and FM Global's "Approval Guide."
  2. Pressure Rating: 175-psig minimum.
  3. Body Material: Cast- or ductile-iron housing with sight glass.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded.
- F. Adjustable Drop Nipples:
1. Standard: UL 1474.
  2. Pressure Rating: 250-psig minimum.
  3. Body Material: Steel pipe with EPDM-rubber O-ring seals.
  4. Size: Same as connected piping.
  5. Length: Adjustable.
  6. Inlet and Outlet: Threaded.
- G. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
  2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  3. Pressure Rating: 175-psig minimum.
  4. Size: Same as connected piping, for sprinkler.
- 2.5 SPRINKLERS
- A. Listed in UL's "Fire Protection Equipment Directory" and FM Global's "Approval Guide."

- B. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
  - 1. Nonresidential Applications: UL 199.
  - 2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes: bronze and painted.
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  - 1. Ceiling Mounting: Plastic, white finish, one piece, flat.
  - 2. Sidewall Mounting: Plastic, white finish, one piece, flat.
- F. Sprinkler Guards:
  - 1. Standard: UL 199.
  - 2. Type: Wire cage with fastening device for attaching to sprinkler.

## 2.6 ALARM DEVICES

- A. Listed in UL's "Fire Protection Equipment Directory" and FM Global's "Approval Guide."
- B. Alarm-device types shall match piping and equipment connections.
- C. Water-Flow Indicators:
  - 1. Standard: UL 346.
  - 2. Water-Flow Detector: Electrically supervised.
  - 3. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
  - 4. Type: Paddle operated.
  - 5. Pressure Rating: 250 psig.
  - 6. Design Installation: Horizontal or vertical.
- D. Pressure Switches:
  - 1. Standard: UL 346.
  - 2. Type: Electrically supervised water-flow switch with retard feature.
  - 3. Components: Single-pole, double-throw switch with normally closed contacts.
  - 4. Design Operation: Rising pressure signals water flow.
- E. Valve Supervisory Switches:
  - 1. Standard: UL 346.
  - 2. Type: Electrically supervised.
  - 3. Components: Single-pole, double-throw switch with normally closed contacts.
  - 4. Design: Signals that controlled valve is in other than fully open position.
  - 5. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.7 PRESSURE GAGES

- A. Standard: UL 393.
- B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- C. Pressure Gage Range: 0- to 250-psig minimum.
- D. Label: Include "WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.

- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they are not subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

### 3.3 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.
- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.
- 3.4 VALVE AND SPECIALTIES INSTALLATION
- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
  - B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- 3.5 SPRINKLER INSTALLATION
- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
  - B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.
- 3.6 IDENTIFICATION
- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
  - B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."



3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Coordinate with fire-pump tests. Operate as required.
  - 7. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain specialty valves.

3.10 PIPING SCHEDULE

- A. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- B. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
  - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- C. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:
  - 1. Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.

2. Schedule 40, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
  1. Rooms without Ceilings: Upright sprinklers.
  2. Rooms with Suspended Ceilings: Concealed sprinklers
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
  1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Upright and Pendent Sprinklers: White Painted in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view.

END OF SECTION

SECTION 22 05 17  
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

2.2 SLEEVE-SEAL SYSTEMS

- 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. Advance Products & Systems, Inc.
  - 2. CALPICO, Inc.
  - 3. Metraflex Company (The).
  - 4. Pipeline Seal and Insulator, Inc.
  - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

### 2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
  2. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  3. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  1. Cut sleeves to length for mounting flush with both surfaces.
  2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 4: Galvanized-Steel-Pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  2. Interior Partitions:
    - a. Piping Smaller Than NPS 4: Galvanized-Steel-Pipe sleeves.
  3. Fire-Barrier Penetrations:
    - a. Piping Smaller Than NPS 4: Galvanized-Steel-Pipe Sleeves.

END OF SECTION

SECTION 22 05 18  
ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Escutcheons.
  - 2. Floor plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Plate, Stamped-Steel Type: With chrome-plated finish, concealed hinge, and spring-clip fasteners.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
  - 1. Escutcheons for New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    - c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    - f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish.
    - g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
  - 1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 22 05 19  
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Bimetallic-actuated thermometers.
  - 2. Liquid-in-glass thermometers.
  - 3. Light-activated thermometers.
  - 4. Thermowells.
  - 5. Dial-type pressure gages.
  - 6. Gage attachments.
  - 7. Test plugs.
  - 8. Test-plug kits.
  - 9. Sight flow indicators.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of meter and gage, from manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.



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**PART 2 - PRODUCTS**

**2.1 BIMETALLIC-ACTUATED THERMOMETERS**

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ashcroft Inc.
2. Ernst Flow Industries.
3. Marsh Bellofram.
4. Miljoco Corporation.
5. Nanmac Corporation.
6. Noshok.
7. Palmer Wahl Instrumentation Group.
8. REOTEMP Instrument Corporation.
9. Tel-Tru Manufacturing Company.
10. Terice, H. O. Co.
11. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
12. Weiss Instruments, Inc.
13. WIKA Instrument Corporation - USA.
14. Winters Instruments - U.S.

B. Standard: ASME B40.200.

C. Case: Liquid-filled and sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass or plastic.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

**2.2 LIQUID-IN-GLASS THERMOMETERS**

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:

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. Terice, H. O. Co.
  2. Standard: ASME B40.200.
  3. Case: Cast aluminum; 6-inch nominal size.
  4. Case Form: Straight unless otherwise indicated.
  5. Tube: Glass with magnifying lens and blue or red organic liquid.
  6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
  7. Window: Glass or plastic.
  8. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  9. Connector: 3/4 inch , with ASME B1.1 screw threads.
  10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
- B. Plastic-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Flo Fab Inc.
    - b. Miljoco Corporation.
    - c. Tel-Tru Manufacturing Company.
    - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
    - e. Weiss Instruments, Inc.
    - f. WIKA Instrument Corporation - USA.
  2. Standard: ASME B40.200.
  3. Case: Plastic; 6-inch nominal size.
  4. Case Form: Straight unless otherwise indicated.
  5. Tube: Glass with magnifying lens and blue or red organic liquid.
  6. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F and deg C.
  7. Window: Glass or plastic.
  8. Stem: Aluminum or brass and of length to suit installation.
    - a. Design for Thermowell Installation: Bare stem.
  9. Connector: 3/4 inch, with ASME B1.1 screw threads.
  10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

## 2.3 LIGHT-ACTIVATED THERMOMETERS

- A. Direct-Mounted, Light-Activated Thermometers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Flo Fab Inc.
  - b. REOTEMP Instrument Corporation.
  - c. Terice, H. O. Co.
  - d. Weiss Instruments, Inc.
  - e. WIKA Instrument Corporation - USA.
  - f. Winters Instruments - U.S.
2. Case: Plastic; 7-inch nominal size unless otherwise indicated.
3. Scale(s): Deg F and deg C.
4. Case Form: Adjustable angle.
5. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
6. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
7. Display: Digital.
8. Accuracy: Plus or minus 2 deg F.

## 2.4 THERMOWELLS

### A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Type: Stepped shank unless straight or tapered shank is indicated.
5. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
6. Internal Threads: 1/2, 3/4, and 1 inch with ASME B1.1 screw threads.
7. Bore: Diameter required to match thermometer bulb or stem.
8. Insertion Length: Length required to match thermometer bulb or stem.
9. Lagging Extension: Include on thermowells for insulated piping and tubing.
10. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

### B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.5 PRESSURE GAGES

### A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Ernst Flow Industries.

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- d. Flo Fab Inc.
  - e. Marsh Bellofram.
  - f. Miljoco Corporation.
  - g. Noshok.
  - h. Palmer Wahl Instrumentation Group.
  - i. REOTEMP Instrument Corporation.
  - j. Tel-Tru Manufacturing Company.
  - k. Terice, H. O. Co.
  - l. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - m. Weiss Instruments, Inc.
  - n. WIKA Instrument Corporation - USA.
  - o. Winters Instruments - U.S.
2. Standard: ASME B40.100.
  3. Case: Sealed Solid-front type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
  4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  6. Movement: Mechanical, with link to pressure element and connection to pointer.
  7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in [psi and kPa.
  8. Pointer: Dark-colored metal.
  9. Window: Glass or plastic.
  10. Ring: Brass or Stainless steel.
  11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.
- B. Direct-Mounted, Plastic-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. AMETEK, Inc.; U.S. Gauge.
    - b. Ashcroft Inc.
    - c. Flo Fab Inc.
    - d. Marsh Bellofram.
    - e. Miljoco Corporation.
    - f. Noshok.
    - g. Palmer Wahl Instrumentation Group.
    - h. REOTEMP Instrument Corporation.
    - i. Tel-Tru Manufacturing Company.
    - j. Terice, H. O. Co.
    - k. Weiss Instruments, Inc.
    - l. WIKA Instrument Corporation - USA.
    - m. Winters Instruments - U.S.
  2. Standard: ASME B40.100.
  3. Case: Sealed type; plastic; 4-1/2-inch nominal diameter.
  4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
  5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
  6. Movement: Mechanical, with link to pressure element and connection to pointer.

7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

## 2.6 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and [piston] [porous-metal]-type surge-dampening device. Include extension for use on insulated piping.
- B. Valves: Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

## 2.7 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Flow Design, Inc.
  2. Miljoco Corporation.
  3. National Meter, Inc.
  4. Peterson Equipment Co., Inc.
  5. Sisco Manufacturing Company, Inc.
  6. Trerice, H. O. Co.
  7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  8. Weiss Instruments, Inc.
- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: EPDM self-sealing rubber.

## 2.8 TEST-PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Flow Design, Inc.
  2. Miljoco Corporation.
  3. National Meter, Inc.
  4. Peterson Equipment Co., Inc.

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5. Sisco Manufacturing Company, Inc.
  6. Trerice, H. O. Co.
  7. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  8. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. Low-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 25 to 125 deg F.
- D. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch-diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- E. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch- diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- F. Carrying Case: Metal or plastic, with formed instrument padding.

**2.9 SIGHT FLOW INDICATORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Archon Industries, Inc.
  2. Dwyer Instruments, Inc.
  3. Emerson Process Management; Brooks Instrument.
  4. Ernst Co., John C., Inc.
  5. Ernst Flow Industries.
  6. KOBOLD Instruments, Inc. - USA; KOBOLD Messring GmbH.
  7. OPW Engineered Systems; a Dover company.
  8. Penberthy; A Brand of Tyco Valves & Controls - Prophetstown.
- B. Description: Piping inline-installation device for visual verification of flow.
- C. Construction: Bronze or stainless-steel body, with sight glass and ball, flapper, or paddle wheel indicator, and threaded or flanged ends.
- D. Minimum Pressure Rating: 125 psig.
- E. Minimum Temperature Rating: 200 deg F.
- F. End Connections for NPS 2 and Smaller: Threaded.
- G. End Connections for NPS 2-1/2 and Larger: Flanged.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install test plugs in piping tees.
- I. Install thermometers in the following locations:
  - 1. Inlet and outlet of each district hot water building service entrance.
- J. Install pressure gages in the following locations:
  - 1. Building water service entrance into building.
  - 2. Inlet and outlet of each pressure-reducing valve.
  - 3. Suction and discharge of each domestic water pump.

#### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

#### 3.3 ADJUSTING

- A. Adjust faces of meters and gages to proper angle for best visibility.

#### 3.4 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each district domestic hot water building entrance shall be one of the following:

1. Liquid-filled Sealed, bimetallic-actuated type.
  2. Compact-style, liquid-in-glass type.
  3. Direct-mounted, light-activated type.
  4. Test plug with EPDM self-sealing rubber inserts.
- B. Thermometer stems shall be of length to match thermowell insertion length.
- 3.5 THERMOMETER SCALE-RANGE SCHEDULE
- A. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.
- B. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.
- 3.6 PRESSURE-GAGE SCHEDULE
- A. Pressure gages at discharge of each water service into building shall be one of the following:
1. Sealed, direct-mounted, metal case.
  2. Sealed, direct-mounted, plastic case.
  3. Test plug with EPDM self-sealing rubber inserts.
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be one of the following:
1. Sealed, direct-mounted, metal case.
  2. Sealed, direct-mounted, plastic case.
  3. Test plug with EPDM self-sealing rubber inserts.
- C. Pressure gages at suction and discharge of each domestic water pump shall be one of the following:
1. Sealed, direct-mounted, metal case.
  2. Sealed, direct-mounted, plastic case.
  3. Test plug with EPDM self-sealing rubber inserts.
- 3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE
- A. Scale Range for Water Service Piping: 0 to 160 psi and 0 to 1100 kPa.
- B. Scale Range for Domestic Water Piping: 0 to 160 psi and 0 to 1100 kPa.

END OF SECTION



SECTION 22 05 23  
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 angle valves.
- 2. Bronze ball valves.
- 3. Bronze lift check valves.
- 4. Bronze swing check valves.
- 5. Bronze globe valves.

- B. Related Sections:

- 1. Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.
- 2. Section 221116 "Domestic Water Piping" 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. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. 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 angle and globe valves closed to prevent rattling.
  - 4. Set ball valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to valve schedule articles 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. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 2 and smaller.
- 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.
- 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.

## 2.2 BRONZE ANGLE VALVES

- A. Class 125, Bronze Angle Valves with Nonmetallic Disc:
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 Valve, Inc.
    - b. NIBCO INC.
  2. Description:
    - a. Standard: MSS SP-80, Type 2.
    - b. CWP Rating: 200 psig.
    - c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
    - d. Ends: Threaded.
    - e. Stem: Bronze.
    - f. Disc: PTFE or TFE.
    - g. Packing: Asbestos free.
    - h. Handwheel: bronze.

## 2.3 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:
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. Conbraco Industries, Inc.; Apollo Valves.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Hammond Valve.
    - d. Lance Valves; a division of Advanced Thermal Systems, Inc.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Two piece.
  - e. Body Material: Bronze.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

#### 2.4 BRONZE LIFT CHECK VALVES

##### A. Class 125, Lift Check Valves with Nonmetallic Disc:

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. Flo Fab Inc.
  - b. Hammond Valve.
  - c. Kitz Corporation.
  - d. Milwaukee Valve Company.
  - e. Mueller Steam Specialty; a division of SPX Corporation.
  - f. NIBCO INC.
  - g. Red-White Valve Corporation.
  - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 200 psig.
  - c. Body Design: Vertical flow.
  - d. Body Material: ASTM B 61 or ASTM B 62, bronze.
  - e. Ends: Threaded.
  - f. Disc: NBR, PTFE, or TFE.

#### 2.5 BRONZE SWING CHECK VALVES

##### A. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Hammond Valve.

- e. Kitz Corporation.
- f. Milwaukee Valve Company.
- g. NIBCO INC.
- h. Red-White Valve Corporation.
- i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 4.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: PTFE or TFE.

2.6 BRONZE GLOBE VALVES

A. Class 125, Bronze Globe Valves with Nonmetallic Disc:

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. Crane Co.; Crane Valve Group; Crane Valves.
- b. Crane Co.; Crane Valve Group; Stockham Division.
- c. NIBCO INC.
- d. Red-White Valve Corporation.

2. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded[ or solder joint].
- e. Stem: Bronze.
- f. Disc: PTFE or TFE.
- g. Packing: Asbestos free.
- h. Handwheel: bronze.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

### 3.2 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 check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.
  - 2. Center-Guided and Plate-Type Check Valves: In horizontal 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. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball valves.
  - 2. Throttling Service: Globe or ball valves.
  - 3. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with nonmetallic disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.

3.5 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. Bronze Angle Valves: Class 125 nonmetallic disc.
3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 125 nonmetallic disc.
5. Bronze Globe Valves: Class 125 nonmetallic disc.

3.6 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. Bronze Angle Valves: Class 125 nonmetallic disc.
3. Ball Valves: Two piece, full port, bronze with stainless-steel trim.
4. Bronze Swing Check Valves: Class 125 nonmetallic disc.

END OF SECTION

SECTION 22 05 29  
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Metal pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Thermal-hanger shield inserts.
  - 4. Fastener systems.
  - 5. Pipe positioning systems.
  - 6. Equipment supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
  - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
  - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:



1. Trapeze pipe hangers.
2. Equipment supports.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

#### 1.7 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

### PART 2 - PRODUCTS

#### 2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
  1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
  2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
  3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
  4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
  5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:
  1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
  2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

#### 2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

#### 2.3 THERMAL-HANGER SHIELD INSERTS

- A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- B. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig, or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

#### 2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

#### 2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

#### 2.6 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

#### 2.7 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
  - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
  - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- E. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

- K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- M. Insulated Piping:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
  - 5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

### 3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Section 099113 "Exterior Painting." AND Section 099123 "Interior Painting."
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

### 3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use carbon-steel pipe hangers and supports and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
  - 4. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 5. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
  - 6. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
  - 7. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
  - 8. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
  - 9. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
  - 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  - 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
  - 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  - 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
  - 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. C-Clamps (MSS Type 23): For structural shapes.
  - 2. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  - 3. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  - 4. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  - 5. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
  
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  - 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  - 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
  
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
  
- O. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.
  
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 22 05 53  
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Equipment labels.
  - 2. Warning signs and labels.
  - 3. Pipe labels.
  - 4. Valve tags.
  - 5. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

- A. Plastic Labels for Equipment:
  - 1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
  - 2. Letter Color: White
  - 3. Background Color: Black
  - 4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  - 5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.



6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, [1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: Size letters according to ASME A13.1 for piping.

#### 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
  - 1. Tag Material: Brass, 0.032-inch or stainless steel, 0.025-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  - 2. Fasteners: Brass wire-link chain or beaded chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
  - 1. Valve-tag schedule shall be included in operation and maintenance data.

#### 2.5 WARNING TAGS

- A. Description: Preprinted or partially preprinted accident-prevention tags of plasticized card stock with matte finish suitable for writing.
  - 1. Size: Approximately 4 by 7 inches.
  - 2. Fasteners: Reinforced grommet and wire.
  - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
  - 4. Color: Safety yellow background with black lettering.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

### 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

### 3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

### 3.4 PIPE LABEL INSTALLATION

- A. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 25 feet along each run.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- B. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- C. Pipe Label Color Schedule:
  - 1. Domestic Water Piping
    - a. Background: Safety green.
    - b. Letter Colors: White.
  - 2. Sanitary Waste Piping:
    - a. Background Color: Safety white.
    - b. Letter Color: Black.
  - 3. Compressed Air and Vacuum Piping
    - a. Background: Blue.
    - b. Letter Colors: White.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches, round.
    - b. Hot Water: 1-1/2 inches, round.
    - c. Compressed Air & Vacuum: 1-1/2 inches, round.
  - 2. Valve-Tag Colors:
    - a. Cold Water: Safety green.
    - b. Hot Water: Safety green.
    - c. Compressed Air & Vacuum: Blue
  - 3. Letter Colors:
    - a. Cold Water: White.
    - b. Hot Water: White
    - c. Compressed Air & Vacuum: White

3.6 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION

SECTION 22 07 19  
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following plumbing piping services:
  - 1. Domestic cold-water piping.
  - 2. Domestic hot-water and recirculating hot-water piping.
  - 3. Supplies and drains for exposed lavatories and sinks.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Fibrex Insulations Inc.; Coreplus 1200.
  - b. Johns Manville; Micro-Lok.
  - c. Knauf Insulation; 1000-Degree Pipe Insulation.
  - d. Manson Insulation Inc.; Alley-K.
  - e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile

Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- D. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Corning Corporation; 739, Dow Silicone.
    - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Speedline Corporation; Polyco VP Adhesive.
  - 2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.3 SEALANTS

- A. Joint Sealants:
  - 1. Joint Sealants for Cellular-Glass and Phenolic Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    - b. Eagle Bridges - Marathon Industries; 405.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    - d. Mon-Eco Industries, Inc.; 44-05.
    - e. Pittsburgh Corning Corporation; Pittseal 444.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Permanently flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 100 to plus 300 deg F.
  - 5. Color: White or gray.
  - 6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.



2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

#### 2.4 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.

#### 2.5 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. 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.

#### 2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide the following] [provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.

- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
  - c. Compac Corporation; 104 and 105.
  - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
2. Width: 3 inches
  3. Thickness: 11.5 mils
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Products: Subject to compliance with requirements, provide the following] [provide one of the following:
    - a. ABI, Ideal Tape Division; 370 White PVC tape.
    - b. Compac Corporation; 130.
    - c. Venture Tape; 1506 CW NS.
  2. Width: 2 inches.
  3. Thickness: 6 mils.
  4. Adhesion: 64 ounces force/inch in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: 18 lbf/inch in width.

## 2.7 SECUREMENTS

- A. Bands:
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. ITW Insulation Systems; Gerrard Strapping and Seals.
    - b. RPR Products, Inc.; Insul-Mate Strapping and Seals.
  2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 1/2 inch wide with wing seal or closed seal.
  3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
- B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
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. C & F Wire.

## 2.8 PROTECTIVE SHIELDING GUARDS

### A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. Engineered Brass Company.
  - b. Insul-Tect Products Co.; a subsidiary of MVG Molded Products.
  - c. McGuire Manufacturing.
  - d. Plumberex.
  - e. Truebro; a brand of IPS Corporation.
  - f. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

### B. Protective Shielding Piping Enclosures:

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. Truebro; a brand of IPS Corporation.
  - b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
  - 1. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
  - 1. Vibration-control devices.
  - 2. Testing agency labels and stamps.
  - 3. Nameplates and data plates.
  - 4. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
  - 1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
  - 1. Pipe: Install insulation continuously through floor penetrations.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
  - 1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  - 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to

- and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
  4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (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.
  5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

#### A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.



3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- B. Domestic Hot Water and Recirculating Hot-Water:
  - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
  - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

- C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures:
    - 1. All Pipe Sizes: Insulation shall be one of the following:
      - a. Protective Shielding Guards.
  
  - D. Floor Drains, Traps, and Sanitary Drain Piping within 10 Feet of Drain Receiving Condensate and Equipment Drain Water below 60 Deg F:
    - 1. All Pipe Sizes: Insulation shall be one of the following:
      - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
- 3.11 INDOOR, FIELD-APPLIED JACKET SCHEDULE
- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
  - B. If more than one material is listed, selection from materials listed is Contractor's option.
  - C. Piping, Exposed:
    - 1. PVC: 30 mils thick.

END OF SECTION

SECTION 22 11 16  
DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.
  - 2. Design and installation of buried domestic hot water supply and return piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For products indicated below.

1.4 INFORMATIONAL SUBMITTALS

- A. System purging and disinfecting activities report.
- B. 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 Owner's written permission.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B 88, Type K, ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type K and ASTM B 88, Type L water tube, annealed temper.
- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. 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.

2.3 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.

2.4 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.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cascade Waterworks Manufacturing.
  - b. Dresser, Inc.; Piping Specialties Products.
  - c. Ford Meter Box Company, Inc. (The).
  - d. JCM Industries.
  - e. Romac Industries, Inc.
  - f. Smith-Blair, Inc.; a Sensus company.
  - g. Viking Johnson.

D. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Charlotte Pipe and Foundry Company.
  - b. Harvel Plastics, Inc.
  - c. Spears Manufacturing Company.
2. 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.

E. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Colonial Engineering, Inc.
  - b. NIBCO Inc.
  - c. Spears Manufacturing Company.
2. Description:
  - a. CPVC or PVC four-part union.
  - b. Brass or stainless-steel threaded end.

- c. Solvent-cement-joint or threaded plastic end.
- d. Rubber O-ring.
- e. Union nut.

## 2.5 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Jomar International.
    - e. Matco-Norca.
    - f. McDonald, A. Y. Mfg. Co.
    - g. Watts; a division of Watts Water Technologies, Inc.
    - h. Wilkins; a Zurn company.
  - 2. Standard: ASSE 1079.
  - 3. Pressure Rating: 125 psig minimum at 180 deg F.
  - 4. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    - b. Central Plastics Company.
    - c. Matco-Norca.
    - d. Watts; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  - 2. Standard: ASSE 1079.
  - 3. Factory-fabricated, bolted, companion-flange assembly.
  - 4. Pressure Rating: 125 psig minimum at 180 deg F.
  - 5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.

- c. Central Plastics Company.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Nonconducting materials for field assembly of companion flanges.
  - 3. Pressure Rating: 150 psig.
  - 4. Gasket: Neoprene or phenolic.
  - 5. Bolt Sleeves: Phenolic or polyethylene.
  - 6. Washers: Phenolic with steel backing washers.
- E. Dielectric Nipples:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Elster Perfection Corporation.
    - b. Grinnell Mechanical Products; Tyco Fire Products LP.
    - c. Matco-Norca.
    - d. Precision Plumbing Products, Inc.
    - e. Victaulic Company.
  - 2. Standard: IAPMO PS 66.
  - 3. Electroplated steel nipple complying with ASTM F 1545.
  - 4. Pressure Rating and Temperature: 300 psig at 225 deg F.
  - 5. End Connections: Male threaded or grooved.
  - 6. Lining: Inert and noncorrosive, propylene.

### PART 3 - EXECUTION

#### 3.1 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 ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. 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."
- F. Install shutoff valve immediately upstream of each dielectric fitting.

- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."
- H. Install domestic water piping level with 0.25 percent slope downward toward drain and plumb.
- I. Rough-in domestic water piping for water-meter installation according to utility company's requirements.
- J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- K. 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.
- L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- M. Install piping to permit valve servicing.
- N. 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.
- O. Install piping free of sags and bends.
- P. Install fittings for changes in direction and branch connections.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
- R. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- T. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.2 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.



- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - 1. Apply appropriate tape or thread compound to external pipe threads.
    - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
  - D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
  - E. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
  - F. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
- 3.3 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.
  - C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.
- 3.4 DIELECTRIC FITTING INSTALLATION
- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  - B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples
- 3.5 HANGER AND SUPPORT INSTALLATION
- A. 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 hangers.
      - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
      - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
    - 3. Base of Vertical Piping: MSS Type 52, spring hangers.

- B. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
- E. Install supports for vertical copper tubing every 10 feet (3 m).
- F. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.6 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. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
  - 2. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
  - 3. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection.

### 3.7 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.

### 3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Piping Inspections:

- a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
- b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
  - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
  - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
- c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
- d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

- a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
  - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  - d. Cap and subject piping to static water pressure of 50 psig (345 kPa) 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.

3.9 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.

### 3.10 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.

### 3.11 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. Aboveground domestic water piping, NPS 2 and smaller, shall be the following:
  1. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; cast- or wrought-copper, solder-joint fittings; and soldered joints.

3.12 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.
  - 2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller.
  - 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.

END OF SECTION

SECTION 22 11 19  
DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing valves.
  - 2. Temperature-actuated, water mixing valves.
  - 3. Strainers.
  - 4. Drain valves.
  - 5. Water-hammer arresters.
  - 6. Air vents.
  - 7. Flexible connectors.
- B. Related Requirements:
  - 1. Section 220519 "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.
  - 2. Section 221116 "Domestic Water Piping" for water meters.
  - 3. Section 224713 "Drinking Fountains" for water filters for water coolers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For domestic water piping specialties.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES**

- A. Potable-water piping and components shall comply with NSF 61 Annex G and NSF 14. Mark "NSF-pw" on plastic piping components.

**2.2 PERFORMANCE REQUIREMENTS**

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

**2.3 BALANCING VALVES**

- A. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.
- B. Memory-Stop Balancing Valves:
  - 1. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.
  - 2. Pressure Rating: 400-psig minimum CWP.
  - 3. Size: NPS 2 or smaller.
  - 4. Body: Copper alloy.
  - 5. Port: Standard or full port.
  - 6. Ball: Chrome-plated brass.
  - 7. Seats and Seals: Replaceable.
  - 8. End Connections: Solder joint or threaded.
  - 9. Handle: Vinyl-covered steel with memory-setting device.

**2.4 TEMPERATURE-ACTUATED, WATER MIXING VALVES**

- A. Water-Temperature Limiting Devices:
  - 1. Standard: ASSE 1017.
  - 2. Pressure Rating: 125 psig.
  - 3. Type: Thermostatically controlled, water mixing valve.
  - 4. Material: Bronze body with corrosion-resistant interior components.
  - 5. Connections: Threaded inlets and outlet.
  - 6. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
- B. Individual-Fixture, Water Tempering Valves:
  - 1. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
  - 2. Pressure Rating: 125 psig minimum unless otherwise indicated.
  - 3. Body: Bronze body with corrosion-resistant interior components.
  - 4. Temperature Control: Adjustable.
  - 5. Inlets and Outlet: Threaded.
  - 6. Finish: Chrome-plated bronze.

## 2.5 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:
  - a. Strainers NPS 2 and Smaller: 0.020 inch.
6. Drain: Factory-installed, hose-end drain valve.

## 2.6 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.7 WATER-HAMMER ARRESTERS

### A. Water-Hammer Arresters:

1. Standard: ASSE 1010 or PDI-WH 201.
2. Type: Metal bellows or Copper tube with piston.
3. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

## 2.8 AIR VENTS

### A. Bolted-Construction Automatic Air Vents:

1. Body: Bronze.
2. Pressure Rating and Temperature: 125-psig minimum pressure rating at 140 deg F.
3. Float: Replaceable, corrosion-resistant metal.
4. Mechanism and Seat: Stainless steel.
5. Size: NPS 1/2 minimum inlet.
6. Inlet and Vent Outlet End Connections: Threaded.



2.9 FLEXIBLE CONNECTORS

- A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.
  - 1. Working-Pressure Rating: Minimum 200 psig.
  - 2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install balancing valves in locations where they can easily be adjusted.
- B. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
- C. Install Y-pattern strainers for water on supply side of each water pressure-reducing valve and pump.
- D. Install water-hammer arresters in water piping according to PDI-WH 201.
- E. Install air vents at high points of water piping. Install drain piping and discharge onto floor drain.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Water pressure-reducing valves.
  - 2. Calibrated balancing valves.
  - 3. Supply-type, trap-seal primer valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

- A. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

- B. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Set field-adjustable flow set points of balancing valves.
- B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 22 13 16  
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Pipe, tube, and fittings.
  - 2. Specialty pipe fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.5 FIELD CONDITIONS

- A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
  - 1. Notify Architect no fewer than two days in advance of proposed interruption of sanitary waste service.
  - 2. Do not proceed with interruption of sanitary waste service without Architect's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:

1. Soil, Waste, and Vent Piping: 10-foot head of water.

## 2.2 PIPING MATERIALS

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

## 2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings: ASTM A 888 or CISPI 301. Pipe and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed by NSF International.
- B. CISPI, Hubless-Piping Couplings:
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. ANACO-Husky.
    - b. Ideal Clamp Products, Inc.
    - c. Mission Rubber Company; a division of MCP Industries, Inc.
    - d. Tyler Pipe.
  2. Standards: ASTM C 1277 and CISPI 310 and shall be listed by NSF International.
  3. Description: Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

## 2.4 COPPER TUBE AND FITTINGS

- A. Copper Type DWV Tube: ASTM B 306, drainage tube, drawn temper.
- B. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought copper, solder-joint fittings.
- C. Hard Copper Tube: ASTM B 88, Type L and Type M, water tube, drawn temper.
- D. Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
- E. Copper Pressure Fittings:
  1. Copper Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
  2. Copper Unions: MSS SP-123, copper-alloy, hexagonal-stock body with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

- F. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end.
  - 1. Flange Gasket Materials: ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
  - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- G. Solder: ASTM B 32, lead free with ASTM B 813, water-flushable flux.

## 2.5 SPECIALTY PIPE FITTINGS

- A. Transition Couplings:
  - 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
  - 2. Shielded, Nonpressure Transition Couplings:
    - a. Standard: ASTM C 1460.
    - b. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
    - c. End Connections: Same size as and compatible with pipes to be joined.
  - 3. Pressure Transition Couplings:
    - a. Standard: AWWA C219.
    - b. Description: Metal, sleeve-type same size as, with pressure rating at least equal to, and ends compatible with, pipes to be joined.
    - c. Center-Sleeve Material: Manufacturer's standard.
    - d. Gasket Material: Natural or synthetic rubber.
    - e. Metal Component Finish: Corrosion-resistant coating or material.
- B. Dielectric Fittings:
  - 1. Dielectric Unions:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Pressure Rating: 125 psig minimum at 180 deg F.
      - 3) End Connections: Solder-joint copper alloy and threaded ferrous.
  - 2. Dielectric Flanges:
    - a. Description:
      - 1) Standard: ASSE 1079.
      - 2) Factory-fabricated, bolted, companion-flange assembly.
      - 3) Pressure Rating: 125 psig minimum at 180 deg F.
      - 4) End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

3. Dielectric-Flange Insulating Kits:
  - a. Description:
    - 1) Nonconducting materials for field assembly of companion flanges.
    - 2) Pressure Rating: 150 psig.
    - 3) Gasket: Neoprene or phenolic.
    - 4) Bolt Sleeves: Phenolic or polyethylene.
    - 5) Washers: Phenolic with steel backing washers.
  
4. Dielectric Nipples:
  - a. Description:
    - 1) Standard: IAPMO PS 66.
    - 2) Electroplated steel nipple.
    - 3) Pressure Rating: 300 psig at 225 deg F.
    - 4) End Connections: Male threaded or grooved.
    - 5) Lining: Inert and noncorrosive, propylene.

### PART 3 - EXECUTION

#### 3.1 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
  1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
  2. Install piping as indicated unless deviations to layout are approved on coordination drawings.
  
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
  
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
  
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
  
- E. Install piping to permit valve servicing.
  
- F. Install piping at indicated slopes.
  
- G. Install piping free of sags and bends.
  
- H. Install fittings for changes in direction and branch connections.
  
- I. Install piping to allow application of insulation.

- J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
  - 1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
  - 2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
    - a. Straight tees, elbows, and crosses may be used on vent lines.
  - 3. Do not change direction of flow more than 90 degrees.
  - 4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
    - a. Reducing size of waste piping in direction of flow is prohibited.
  
- K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
  - 1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
  - 2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
  - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
  
- L. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  
- M. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
  
- N. Plumbing Specialties:
  - 1. Install drains in sanitary waste gravity-flow piping.
    - a. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."
  
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
  
- P. Install sleeves for piping penetrations of walls, ceilings, and floors.
  - 1. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
  
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs.
  - 1. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
  
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors.

1. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

### 3.2 JOINT CONSTRUCTION

- A. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
  1. Cut threads full and clean using sharp dies.
  2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
    - a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
    - b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
    - c. Do not use pipe sections that have cracked or open welds.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.
- D. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

### 3.3 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
  1. Install transition couplings at joints of piping with small differences in ODs.
  2. In Waste Drainage Piping: Shielded, nonpressure transition couplings.
  3. In Aboveground Force Main Piping: Fitting-type transition couplings.
  4. In Underground Force Main Piping:
    - a. NPS 1-1/2 and Smaller: Fitting-type transition couplings.
    - b. NPS 2 and Larger: Pressure transition couplings.
- B. Dielectric Fittings:
  1. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
  2. Dielectric Fittings for NPS 2 and Smaller: Use dielectric nipples or unions.
  3. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits, or nipples.



3.4 VALVE INSTALLATION

- A. Comply with requirements in Section 220523 "General Duty Valves for Plumbing Piping".

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
  - 1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
  - 2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
  - 3. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 4. Install individual, straight, horizontal piping runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 5. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 6. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4: 60 inches with 5/8-inch rod.
  - 4. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 and NPS 4: 10 feet with 1/2-inch rod.

- H. Install supports for vertical copper tubing every 10 feet.
- I. Support piping and tubing not listed above according to MSS SP-58 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect waste and vent piping to the following:
  - 1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
  - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
  - 4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
  - 5. Comply with requirements for cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
  - 6. Equipment: Connect waste piping as indicated.
    - a. Provide shutoff valve if indicated and union for each connection.
    - b. Use flanges instead of unions for connections NPS 2-1/2 and larger.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.
- D. 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.

### 3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping.
- B. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary waste and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired.
    - a. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
  2. Leave uncovered and unconcealed new, altered, extended, or replaced waste and vent piping until it has been tested and approved.
    - a. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test waste and vent piping except outside leaders on completion of roughing-in.
    - a. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water.
    - b. From 15 minutes before inspection starts to completion of inspection, water level must not drop.
    - c. Inspect joints for leaks.
  4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight.
    - a. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg.
    - b. Use U-tube or manometer inserted in trap of water closet to measure this pressure.
    - c. Air pressure must remain constant without introducing additional air throughout period of inspection.
    - d. Inspect plumbing fixture connections for gas and water leaks.
  5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- D. Repair damage to adjacent materials caused by waste and vent piping installation.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  - 2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.
- C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
  - 1. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
  - 2. Copper Type DWV tube, copper drainage fittings, and soldered joints.
    - a. Option for Vent Piping, NPS 2-1/2 and NPS 3-1/2: Hard copper tube, Type M; copper pressure fittings; and soldered joints.
  - 3. Dissimilar Pipe-Material Couplings: Shielded, nonpressure transition couplings.

END OF SECTION

SECTION 22 13 19  
SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Cleanouts.
  - 2. Through-penetration firestop assemblies.
  - 3. Miscellaneous sanitary drainage piping specialties.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene.
- B. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For sanitary waste piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

- A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

- B. Comply with NSF 14 for plastic sanitary waste piping specialty components.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing, and marked for intended location and application.

## 2.2 CLEANOUTS

### A. Cast-Iron Exposed Cleanouts:

- 1. Standard: ASME A112.36.2M.
- 2. Size: Same as connected drainage piping
- 3. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 4. Closure: Countersunk, brass or cast-iron plug.
- 5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

### B. Cast-Iron Exposed Floor Cleanouts:

- 1. Standard: ASME A112.36.2M for cast-iron soil pipe with cast-iron ferrule, threaded, adjustable housing] cleanout.
- 2. Size: Same as connected branch.
- 3. Type: Cast-iron soil pipe with cast-iron ferrule, threaded, adjustable housing.
- 4. Body or Ferrule: Cast iron.
- 5. Outlet Connection: Threaded.
- 6. Closure: Brass plug with straight threads and gasket.
- 7. Adjustable Housing Material: Cast iron with threads.
- 8. Frame and Cover Material and Finish: Polished bronze.
- 9. Frame and Cover Shape: Square.
- 10. Top Loading Classification: Light Duty.
- 11. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.

### C. Cast-Iron Wall Cleanouts:

- 1. Standard: ASME A112.36.2M. Include wall access.
- 2. Size: Same as connected drainage piping.
- 3. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
- 4. Closure Plug:
  - a. Brass.
  - b. Countersunk head.
  - c. Drilled and threaded for cover attachment screw.
  - d. Size: Same as or not more than one size smaller than cleanout size.
- 5. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.

## 2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564 rubber gaskets.
  2. Size: Same as connected waste piping.
- B. Deep-Seal Traps:
1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
  2. Size: Same as connected waste piping.
    - a. NPS 2: 4-inch- minimum water seal.
    - b. NPS 2-1/2 and Larger: 5-inch- minimum water seal.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- D. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- E. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.
- F. Install wood-blocking reinforcement for wall-mounting-type specialties.
- G. Install traps on plumbing specialty drain outlets.

#### 3.2 CONNECTIONS

- A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

### 3.3 FLASHING INSTALLATION

- A. Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim."
- B. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required.
- C. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- D. Set flashing on floors and roofs in solid coating of bituminous cement.
- E. Secure flashing into sleeve and specialty clamping ring or device.
- F. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."
- G. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### 3.4 LABELING AND IDENTIFYING

- A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
  - 1. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections, and prepare test reports.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled FOG disposal systems and their installation, including piping and electrical connections, and to assist in testing.
- B. Tests and Inspections:



1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.6 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION

SECTION 22 15 13  
GENERAL-SERVICE COMPRESSED-AIR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes piping and related specialties for general-service compressed-air systems operating at 200 psig or less.

1.3 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. CR: Chlorosulfonated polyethylene synthetic rubber.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. HDPE: High-density polyethylene plastic.
- E. NBR: Acrylonitrile-butadiene rubber.
- F. PE: Polyethylene plastic.
- G. PVC: Polyvinyl chloride plastic.
- H. High-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures between 150 and 200 psig.
- I. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Dielectric fittings.
  - 2. Flexible pipe connectors.
  - 3. Safety valves.
  - 4. Pressure regulators. Include rated capacities and operating characteristics.
  - 5. Automatic drain valves.
  - 6. Filters. Include rated capacities and operating characteristics.

7. Quick couplings.
8. Hose assemblies.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Brazing certificates.
- B. Qualification Data: For Installers.
- C. Field quality-control test reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

#### 1.7 QUALITY ASSURANCE

- A. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications," or to AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."
- B. ASME Compliance:
  1. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

#### 1.8 PROJECT CONDITIONS

- A. Interruption of Existing Compressed-Air Service: Do not interrupt compressed-air service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary compressed-air service according to requirements indicated:
  1. Notify Construction Manager no fewer than two days in advance of proposed interruption of compressed-air service.
  2. Do not proceed with interruption of compressed-air service without [Construction Manager's written permission.

### PART 2 - PRODUCTS

#### 2.1 PIPES, TUBES, AND FITTINGS

- A. Copper Tube: ASTM B 88, Type K or L and ASTM B 88, Type M seamless, drawn-temper, water tube.
  1. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type or MSS SP-73, wrought copper with dimensions for brazed joints.

2. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150 or 300.
  3. Copper Unions: ASME B16.22 or MSS SP-123.
- B. Transition Couplings for Metal Piping: Metal coupling or other manufactured fitting same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

## 2.2 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch 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.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, 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/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

## 2.3 VALVES

- A. Metal Ball, Butterfly, Check, and Gate Valves: Comply with requirements in Section 220523.12 "Ball Valves for Plumbing Piping," Section 220523.13 "Butterfly Valves for Plumbing Piping," Section 220523.14 "Check Valves for Plumbing Piping," and Section 220523.15 "Gate Valves for Plumbing Piping."

## 2.4 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
  1. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F].

- c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
  - 1. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig minimum at 180 deg F.
    - d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.
- D. Dielectric-Flange Insulating Kits:
  - 1. Description:
    - a. Nonconducting materials for field assembly of companion flanges.
    - b. Pressure Rating: 150 psig.
    - c. Gasket: Neoprene or phenolic.
    - d. Bolt Sleeves: Phenolic or polyethylene.
    - e. Washers: Phenolic with steel backing washers.

## 2.5 FLEXIBLE PIPE CONNECTORS

- A. Bronze-Hose Flexible Pipe Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
  - 1. Working-Pressure Rating: 200 psig minimum.
  - 2. End Connections, NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
  - 3. End Connections, NPS 2-1/2 and Larger: Flanged copper alloy.

## 2.6 SPECIALTIES

- A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
  - 1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.
- B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for [250-psig] <Insert pressure> inlet pressure, unless otherwise indicated.
  - 1. Type: Pilot operated.
- C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

- D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for [200-psig] <Insert pressure> minimum working pressure, capable of automatic discharge of collected condensate.[ Include mounting bracket if wall mounting is indicated.]
- E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded.[ Include mounting bracket if wall mounting is indicated.]
- F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock.[ Include mounting bracket if wall mounting is indicated.]
- G. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal.[ Include mounting bracket if wall mounting is indicated.]
  - 1. Provide with automatic feed device for supplying oil to lubricator.

## 2.7 QUICK COUPLINGS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Aeroquip Corporation; Eaton Corp.
  - 2. Bowes Manufacturing Inc.
  - 3. Foster Manufacturing, Inc.
  - 4. Milton Industries, Inc.
  - 5. Parker Hannifin Corp.; Fluid Connectors Group; Quick Coupling Div.
  - 6. Rectus Corp.
  - 7. Schrader-Bridgeport; Amflo Div.Schrader-Bridgeport/Standard Thomson.
  - 8. Snap-Tite, Inc.; Quick Disconnect & Valve Division.
- B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.
- C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
  - 1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
  - 2. Plug End: Straight-through type with barbed outlet for attaching hose.
- D. Valveless Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
  - 1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
  - 2. Plug End: With barbed outlet for attaching hose.

## 2.8 HOSE ASSEMBLIES

- A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
  - 1. Hose: Reinforced double-wire-braid, CR-covered hose for compressed-air service.
  - 2. Hose Clamps: Stainless-steel clamps or bands.
  - 3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
  - 4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

- A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:
  - 1. NPS 2 and Smaller: Type K or L, copper tube; wrought-copper fittings; and brazed joints.
- B. Low-Pressure Compressed-Air Distribution Piping: Use the following piping materials for each size range:
  - 1. NPS 2 and Smaller: Type K or L, copper tube; press-type fittings; and pressure-sealed joints.
- C. Drain Piping: Use one of the following piping materials:
  - 1. NPS 2 and Smaller: Type M copper tube; wrought-copper fittings; and brazed or soldered joints.

### 3.2 VALVE APPLICATIONS

- A. Metal General-Duty Valves: Comply with requirements and use valve types specified in "Valve Applications" Articles in Section 220523 according to the following:
  - 1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
  - 2. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

### 3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe

and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

- B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.
- E. Install piping adjacent to equipment and machines to allow service and maintenance.
- F. Install air and drain piping with 1 percent slope downward in direction of flow.
- G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.
- H. Equipment and Specialty Flanged Connections:
  - 1. Use steel companion flange with gasket for connection to steel pipe.
  - 2. Use cast-copper-alloy companion flange with gasket and brazed joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.
- I. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- J. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.
- K. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."
- L. Install piping to permit valve servicing.
- M. Install piping free of sags and bends.
- N. Install fittings for changes in direction and branch connections.
- O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."



- Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

#### 3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. 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.
- D. Brazed Joints for Copper Tubing: Join according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- E. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

#### 3.5 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Section 220523 "General Duty Valves for Plumbing Piping."
- B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.
- C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.
- D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

#### 3.6 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. NPS 2 and Smaller: Use dielectric unions.

#### 3.7 FLEXIBLE PIPE CONNECTOR INSTALLATION

- A. Install flexible pipe connectors in discharge piping of each air compressor.

- B. Install bronze-hose flexible pipe connectors in copper compressed-air tubing.

### 3.8 SPECIALTY INSTALLATION

- A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.
- B. Install air-line pressure regulators in branch piping to equipment and tools.
- C. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.
- D. Install quick couplings at piping terminals for hose connections.
- E. Install hose assemblies at hose connections.

### 3.9 CONNECTIONS

- A. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.
- B. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

### 3.10 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- B. Vertical Piping: MSS Type 8 or 42, clamps.
- C. Individual, Straight, Horizontal Piping Runs:
  - 1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
  - 2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
- D. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
- E. Base of Vertical Piping: MSS Type 52, spring hangers.
- F. Support horizontal piping within 12 inches of each fitting and coupling.
- G. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- H. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

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1. NPS 1/4: 60 inches with 3/8-inch rod.
2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
3. NPS 3/4: 84 inches with 3/8-inch rod.
4. NPS 1: 96 inches with 3/8-inch rod.
5. NPS 1-1/4: 108 inches with 3/8-inch rod.
6. NPS 1-1/2: 10 feet with 3/8-inch rod.
7. NPS 2: 11 feet with 3/8-inch rod.

- I. Install supports for vertical copper tubing every 10 feet.

**3.11 LABELING AND IDENTIFICATION**

- A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

**3.12 FIELD QUALITY CONTROL**

- A. Perform field tests and inspections.
- B. Tests and Inspections:
  1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
  2. Repair leaks and retest until no leaks exist.
  3. Inspect filters and pressure regulators for proper operation.
- C. Prepare test reports.

END OF SECTION

SECTION 22 42 13  
COMMERCIAL WATER CLOSETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Water closets.
  - 2. Flushometer valves.
  - 3. Toilet seats.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water closets.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Flushometer-Valve Repair Kits: Equal to 10 percent of amount of each type installed, but no fewer than six of each type.

**PART 2 - PRODUCTS**

**2.1 WALL-MOUNTED WATER CLOSETS**

- A. Water Closets: Wall mounted, top spud, accessible.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Crane Plumbing, L.L.C.
    - c. Kohler Co.
    - d. Mansfield Plumbing Products LLC.
    - e. Zurn Industries, LLC; Commercial Brass and Fixtures.
    - f. Sloan
  2. Bowl:
    - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
    - b. Material: Vitreous china.
    - c. Type: Siphon jet.
    - d. Style: Flushometer valve.
    - e. Height: Standard.
    - f. Rim Contour: Elongated.
    - g. Water Consumption: 1.28 gal. per flush.
    - h. Spud Size and Location: NPS 1-1/2; top.

**2.2 FLUSHOMETER VALVES**

- A. Battery-Powered, Solenoid-Actuator, Piston Flushometer Valves:
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Coyne & Delany Co.
    - b. Gerber Plumbing Fixtures LLC.
    - c. Hydrotek International, Inc.
    - d. Kohler Co.
    - e. Moen Incorporated.
    - f. Sloan Valve Company.
    - g. TOTO USA, INC.
    - h. Zurn Industries, LLC; Commercial Brass and Fixtures.
  2. Standard: ASSE 1037.
  3. Minimum Pressure Rating: 125 psig.
  4. Features: Include integral check stop and backflow-prevention device.
  5. Material: Brass body with corrosion-resistant components.
  6. Exposed Flushometer-Valve Finish: Chrome plated.
  7. Panel Finish: Chrome plated or stainless steel.
  8. Style: Exposed.
  9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

10. Trip Mechanism: Battery-powered electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: 1.28 gal. per flush.
12. Minimum Inlet: NPS 1
13. Minimum Outlet: NPS 1-1/4

### 2.3 TOILET SEATS

#### A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. American Standard America.
  - b. Bemis Manufacturing Company.
  - c. Church Seats.
  - d. Jones Stephens Corp.; Comfort Seat Brand.
  - e. Kohler Co.
  - f. Olsonite Seat Co.
  - g. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Commercial Heavy duty.
5. Shape: Elongated rim, open front .
6. Hinge: Self-sustaining, check.
7. Hinge Material: Non-corroding metal.
8. Seat Cover: Not required.
9. Color: White

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.
- B. Examine walls and floors for suitable conditions where water closets will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

#### A. Water-Closet Installation:

1. Install level and plumb according to roughing-in drawings.
2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.

3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.
- B. Support Installation:
1. Use carrier supports with waste-fitting assembly and seal.
  2. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.
- C. Flushometer-Valve Installation:
1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
  2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
  3. Install actuators in locations that are easy for people with disabilities to reach.
  4. Install fresh batteries in battery-powered, electronic-sensor mechanisms.
- D. Install toilet seats on water closets.
- E. Wall Flange and Escutcheon Installation:
1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
  2. Install deep-pattern escutcheons if required to conceal protruding fittings.
  3. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- F. Joint Sealing:
1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
  2. Match sealant color to water-closet color.
  3. Comply with sealant requirements specified in Division 7 Section "Joint Sealants."

### 3.3 CONNECTIONS

- A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."
- D. Where installing piping adjacent to water closets, allow space for service and maintenance.

**New Jersey City University: Nursing Education Center  
Renovations to Rossey Hall**

2039 John F. Kennedy Boulevard  
Jersey City, NJ 07305

**Clarke Caton Hintz  
Construction Documents**

December 4, 2017

3.4 ADJUSTING

- A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.
- B. Adjust water pressure at flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed water closets and fittings.
- C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION



SECTION 22 42 16  
COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Lavatories.
  - 2. Faucets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for lavatories.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
  - 1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
    - a. Servicing and adjustments of automatic faucets.

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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.
  - 2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

- A. Lavatory: Oval, self-rimming, vitreous china, counter mounted.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Crane Plumbing, L.L.C.
    - c. Gerber Plumbing Fixtures LLC.
    - d. Kohler Co.
    - e. Mansfield Plumbing Products LLC.
    - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
    - g. Sloan
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: Self-rimming for above-counter mounting.
    - c. Color: White
    - d. Mounting Material: Sealant. Faucet-Hole Punching: Three holes, 4-inch centers.
    - e. Faucet-Hole Location: Top.
- B. Lavatory: Oval, vitreous china, undercounter mounted.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Crane Plumbing, L.L.C.
    - c. Gerber Plumbing Fixtures LLC.
    - d. Kohler Co.
    - e. Mansfield Plumbing Products LLC.
    - f. Zurn Industries, LLC; Commercial Brass and Fixtures.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: For undercounter mounting.

- c. Faucet-Hole Punching: No holes.
- d. Faucet-Hole Location: On countertop.
- e. Color: White
- f. Mounting Material: Sealant and undercounter mounting kit.

## 2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

- A. Lavatory: Vitreous china, wall mounted.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Briggs Plumbing Products, Inc.
    - c. Crane Plumbing, L.L.C.
    - d. Ferguson Enterprises, Inc.; ProFlo Brand.
    - e. Gerber Plumbing Fixtures LLC.
    - f. Kohler Co.
    - g. Mansfield Plumbing Products LLC.
    - h. Peerless Pottery Sales, Inc.
    - i. Zurn Industries, LLC; Commercial Brass and Fixtures.
  - 2. Fixture:
    - a. Standard: ASME A112.19.2/CSA B45.1.
    - b. Type: For wall hanging.
    - c. Color: White

## 2.3 SOLID-BRASS, MANUALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, two-handle mixing, solid-brass valve.
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Bradley Corporation.
    - c. Chicago Faucets.
    - d. Delta Faucet Company.
    - e. Elkay Manufacturing Co.
    - f. Grohe America, Inc.
    - g. Just Manufacturing.
    - h. Kohler Co.
    - i. Moen Incorporated.
    - j. Speakman Company.
    - k. T & S Brass and Bronze Works, Inc.
    - l. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate
7. Mounting Type: Deck, concealed.
8. Valve Handle(s): Wrist blade, 4 inches.
9. Spout: Rigid type.
10. Drain: Pop-up.

#### 2.4 SOLID-BRASS, AUTOMATICALLY OPERATED LAVATORY FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Automatic-type, electronic-sensor-operated, non-mixing, solid-brass valve.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Chicago Faucets.
    - c. Grohe America, Inc.
    - d. Hydrotek International, Inc.
    - e. Kohler Co.
    - f. Moen Incorporated.
    - g. Sloan Valve Company.
    - h. Speakman Company.
    - i. T & S Brass and Bronze Works, Inc.
    - j. Zurn Industries, LLC; Commercial Brass and Fixtures.
  2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
  3. 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.
  4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

#### 2.5 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

- D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
  - 1. ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

## 2.6 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where lavatories will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install lavatories level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-mounted lavatories.
- C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 7 Section "Joint Sealants."
- F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of lavatories. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of lavatories, inspect and repair damaged finishes.
- B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed lavatories and fittings.
- D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 22 42 17  
COMMERCIAL SINKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Handwash sinks.
  - 2. Sink faucets.
  - 3. Supply fittings.
  - 4. Waste fittings.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sinks 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. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

## PART 2 - PRODUCTS

### 2.1 HANDWASH SINKS

- A. Handwash Sinks: Stainless steel, counter mounted.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. AERO Manufacturing Company.
    - b. Amtekco Industries, Inc.
    - c. Eagle Group; Foodservice Equipment Division.
    - d. Elkay Manufacturing Co.
    - e. Griffin Products, Inc.
    - f. Just Manufacturing.
  2. Fixture:
    - a. Standards: ASME A112.19.3/CSA B45.4 and NSF/ANSI 2.
  3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
  4. Waste Fittings: Comply with requirements in "Waste Fittings" Article.
  5. Support: Counter

### 2.2 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: Manual type, two-lever-handle mixing valve.
  1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. American Standard America.
    - b. Chicago Faucets.
    - c. Elkay Manufacturing Co.
    - d. Just Manufacturing.
    - e. Kohler Co.
    - f. Moen Incorporated.
    - g. Speakman Company.
    - h. T & S Brass and Bronze Works, Inc.
    - i. Zurn Industries, LLC; Commercial Brass and Fixtures.
  2. Standard: ASME A112.18.1/CSA B125.1.
  3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
  4. Body Type: Single hole.
- C. Sink Faucets: Automatic, battery-powered, electronic-sensor-operated mixing valve.



1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - a. American Standard America.
  - b. Chicago Faucets.
  - c. Elkay Manufacturing Co.
  - d. Just Manufacturing.
  - e. Kohler Co.
  - f. Moen Incorporated.
  - g. Speakman Company.
  - h. T & S Brass and Bronze Works, Inc.
  - i. Zurn Industries, LLC; Commercial Brass and Fixtures.
2. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
3. 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.
4. Configuration: Hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
5. Body Type: Single hole.
6. Body Material: Solid brass.
7. Finish: Polished chrome plate.
8. Maximum Flow Rate: 2.2 gpm unless otherwise indicated.
9. Mounting Type: Deck, exposed.
10. Spout Type: Rigid, gooseneck.

### 2.3 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Wheel handle.
- F. Risers:
  1. ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

### 2.4 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.

- C. Trap:
  - 1. Size: NPS 1-1/2.

## 2.5 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
  - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
  - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 7 Section "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

### 3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

### 3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

### 3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 224713  
DRINKING FOUNTAINS

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 drinking fountains and related components.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of drinking fountain.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
  - 2. Include operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For drinking fountains to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 DRINKING FOUNTAINS

- A. Drinking Fountains: Stainless steel, wall mounted.
  - 1. Stainless-Steel Drinking Fountains: As indicated on drawings.
  - 2. Standards:
    - a. Comply with ASME A112.19.3/CSA B45.4.
    - b. Comply with NSF 61 Annex G.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.
- B. Examine walls and floors for suitable conditions where fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.
- B. Set pedestal drinking fountains on floor.
- C. Install recessed drinking fountains secured to wood blocking in wall construction.
- D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.
- E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.
- G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."
- H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

**3.3 CONNECTIONS**

- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

- C. Install ball or gate shutoff valve on water supply to each fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
- D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

- A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION

SECTION 23 05 00  
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Grout.
5. HVAC demolition.
6. Equipment installation requirements common to equipment sections.
7. Supports and anchorages.

1.4 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct 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. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and chases.
- D. The following are industry abbreviations for plastic materials:
1. CPVC: Chlorinated polyvinyl chloride plastic.
  2. PE: Polyethylene plastic.
  3. PVC: Polyvinyl chloride plastic.
- E. The following are industry abbreviations for rubber materials:
1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

1.4 REVIEW OF CONTRACT DOCUMENTS AND SITE

- A. With the submission of his Bid, Contractor shall give written notice to the Owner of any materials or apparatus believed inadequate or unsuitable, in violation of laws, ordinances, rules or regulations of Authorities having jurisdiction, and any necessary items of work omitted. In the absence of such written notice it is mutually agreed that the Contractor has included the cost of all required items in his Proposal for a complete project.
- B. Contractor shall acknowledge that he has examined the Plans, Specifications and Site, and that from his own investigations he has satisfied himself as to the nature and location of the work; the general and local conditions, particularly those bearing upon transportation, disposal, handling, and storage of materials; availability of labor, water, electric power, roads and uncertainties of weather; the conformation and condition of the ground; the character, quality and quantity of surface and subsurface materials to be encountered; the character of equipment and facilities needed preliminary to and during the execution of the work; all federal, state, county, township and municipal laws, ordinances and regulations particularly those relating to employment of labor, rates of wages, and construction methods; and all other matters which can in any way affect the work or the cost thereof under this Contract. Any failure by the Contractor to acquaint himself with the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.
- C. All Mechanical Drawings are schematic and diagrammatic.
  - 1. Symbols and diagrams are used to indicate the various items of work and the complete systems, but they do not necessarily have dimensional significance, neither do they necessarily include all related and subsidiary parts and equipment.
  - 2. The work is to be installed complete and ready for operation in conformity with the intent expressed on the Drawings and in the Specifications.
  - 3. Required relocation of components or modifications of size or routing shall be provided by the contractor at no additional expense.
  - 4. Do not purchase or install equipment, piping or ductwork without prior receipt of approved shop drawings. Contractor shall remove and re-install any such work which is in conflict with shop drawing comments.
- D. Where these specifications call for specific manufacturers and/or model numbers, substitutions shall not be permitted.

### 1.3 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 HVAC Equipment: Equipment of different 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 at no additional cost. Equipment shall equal or exceed energy ratings of basis of design equipment.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.
- C. Protect ductwork from moisture. Ductwork which has been exposed to moisture shall be cleaned and disinfected. All lined ductwork which has been exposed to moisture shall be discarded.

#### 1.5 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for HVAC installations. Break down equipment into individual components to allow entry into the building.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Prepare coordination drawings to a scale of 3/8"=1'-0" or larger; detailing major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Draw elevations of air handling units with attached ductwork. Show all existing piping, structure and other systems which affect the work.

Indicate locations where space is limited for installation and access and where sequencing and coordination of installations are of importance to the efficient flow of the Work, including (but not necessarily limited to) the following:

1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
  - a. Clearances for installing and maintaining insulation.
  - b. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
  - c. Valve stem movement.
  - d. Demonstrate accessibility of dampers, valves, etc. from floor level.
  - e. Demonstrate accessibility of fire dampers and radiation dampers.
  - f. Give elevations of all components.
  - g. Show all structure which affects component location or elevation.

2. Prepare floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.
3. Attend coordination meetings as necessary and modify coordination drawings as needed to enable all systems to be installed as per the design intent.
4. If, through their best efforts, contractors cannot resolve coordination issues, all necessary information shall be indicated for resolution by the Engineer.

#### 1.6 TRAINING

- A. Training on equipment, systems and controls shall be provided by the contractor. Manufacturer's representative shall give training for fan coil units and building controls systems. Provide, as a minimum, the number of hours of training specified in other sections. Owner shall provide written certification that training was provided and was sufficient.

#### 1.8 GUARANTEE

- A. The entire HVAC installation shall be fully guaranteed for a period of one year. Replace all filters used during construction with new before occupancy. Turn over one complete set of filters for each item of equipment to the Owner at the completion of the work.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

#### 2.2 PIPE, TUBE, AND FITTINGS

- A. Refer to individual 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 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

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1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch 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 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.
- G. Solvent Cements for Joining Plastic Piping:
1. CPVC Piping: ASTM F 493.
  2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

#### 2.4 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 Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig 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.
- D. Dielectric Waterway
1. Manufacturer:
    - a. Victaulic Co. of America.

#### 2.5 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and 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 to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Verify final equipment locations for roughing-in.
- L. 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 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. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
  - 3. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  - 4. PVC Nonpressure Piping: Join according to ASTM D 2855.
- J. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

### 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. All Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.

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3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install HVAC equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease, air bleed and drain fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

3.5 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.6 TRAINING

- A. Training on equipment, systems and controls shall be provided by the contractor. Manufacturer's representative shall give training for air handling unit and building controls systems. Provide, as a minimum, eight hours of training in addition to specific equipment training specified in other sections.

END OF SECTION

SECTION 23 05 13  
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
  - 1. Motor controllers.
  - 2. Torque, speed, and horsepower requirements of the load.
  - 3. Ratings and characteristics of supply circuit and required control sequence.
  - 4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.
- C. Comply with IEEE 841 for severe-duty motors.

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2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.
  - 2. Split phase.
  - 3. Capacitor start, inductor run.
  - 4. Capacitor start, capacitor run.
- B. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- C. Motors 1/20 HP and Smaller: Shaded-pole type.
- D. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION



SECTION 23 05 19  
METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Liquid-in-glass thermometers.
  - 2. Thermowells.
  - 3. Dial-type pressure gages.
  - 4. Gage attachments.
  - 5. Test plugs.
  - 6. Test-plug kits.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product Certificates: For each type of meter and gage, from manufacturer.
- C. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Palmer Wahl Instrumentation Group.
    - b. Terice, H. O. Co.
    - c. Weiss Instruments, Inc.
  - 2. Standard: ASME B40.200.

3. Case: Cast aluminum; 9-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue or red organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
  - a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Scale Range for Dual Temperature Water Piping: 0 to 250 deg F.

C. Scale Range for Air Ducts: 40 to 180 deg F.

## 2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.
10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

## 2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. AMETEK, Inc.; U.S. Gauge.
  - b. Ashcroft Inc.
  - c. Terice, H. O. Co.
  - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
  - e. Weiss Instruments, Inc.

2. Standard: ASME B40.100.
3. Case: Liquid-filled type(s); cast aluminum or drawn steel; 6-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Stainless steel.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

- B. Scale Range: 0 to 100 psi.

#### 2.4 GAGE ATTACHMENTS

- A. Valves: Brass or stainless-steel needle, with NPS 1/2, ASME B1.20.1 pipe threads.

#### 2.5 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flow Design, Inc.
2. National Meter, Inc.
3. Peterson Equipment Co., Inc.
4. Sisco Manufacturing Company, Inc.
5. Trelice, H. O. Co.
6. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
7. Weiss Instruments, Inc.

- B. Description: Test-station fitting made for insertion into piping tee fitting.

- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.

- D. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.

- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.

- F. Core Inserts: Chlorosulfonated polyethylene synthetic and EPDM self-sealing rubber.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- H. Install remote-mounted pressure gages on panel.
- I. Install valve and snubber in piping for each pressure gage for fluids.
- J. Install test plugs in piping tees.
- K. Install permanent indicators on walls or brackets in accessible and readable positions.
- L. Install connection fittings in accessible locations for attachment to portable indicators.
- M. Install thermometers as indicated on the drawings.
- N. Install pressure gages as indicated on the drawings.

### 3.2 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

### 3.3 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

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END OF SECTION

SECTION 23 05 23  
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Brass ball valves.
  - 2. Iron ball valves.
  - 3. Bronze swing check valves.
  - 4. Bronze gate valves.
  - 5. Iron gate valves.
  - 6. Bronze globe valves.
  - 7. Iron globe valves.
- B. Related Sections:
  - 1. Division 23 HVAC piping Sections for specialty valves applicable to those Sections only.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.9 for building services piping valves.

#### 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 angle, gate, and globe valves closed to prevent rattling.
  - 4. Set ball valves open to minimize exposure of functional surfaces.
  - 5. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
  - 1. Maintain valve end protection.
  - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles 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. Handwheel: For valves other than quarter-turn types.
  - 2. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
  - 3. 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. Gate Valves: With rising stem.
  - 2. 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.
- 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.

## 2.2 BRASS BALL VALVES

A. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Jomar International, LTD.
  - b. Kitz Corporation.
  - c. Marwin Valve; a division of Richards Industries.
  - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-110.
  - b. SWP Rating: 150 psig.
  - c. CWP Rating: 600 psig.
  - d. Body Design: Three piece.
  - e. Body Material: Forged brass.
  - f. Ends: Threaded.
  - g. Seats: PTFE or TFE.
  - h. Stem: Stainless steel.
  - i. Ball: Stainless steel, vented.
  - j. Port: Full.

## 2.3 BRONZE SWING CHECK VALVES

A. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Hammond Valve.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 4.
  - b. CWP Rating: 300 psig.
  - c. Body Design: Horizontal flow.
  - d. Body Material: ASTM B 62, bronze.



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- e. Ends: Threaded.
- f. Disc: PTFE or TFE.

**2.4 BRONZE GATE VALVES**

**A. Class 150, NRS Bronze Gate Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following]:
  - a. Hammond Valve.
  - b. Kitz Corporation.
  - c. Milwaukee Valve Company.
  - d. NIBCO INC.
  - e. Powell Valves.
  - f. Red-White Valve Corporation.
  - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
  - a. Standard: MSS SP-80, Type 1.
  - b. CWP Rating: 300 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
  - d. Ends: Threaded.
  - e. Stem: Bronze.
  - f. Disc: Solid wedge; bronze.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron.

**2.5 IRON GATE VALVES**

**A. Class 125, OS&Y, Iron Gate Valves:**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Flo Fab Inc.
  - e. Hammond Valve.
  - f. Kitz Corporation.
  - g. Legend Valve.
  - h. Milwaukee Valve Company.
  - i. NIBCO INC.
  - j. Powell Valves.
  - k. Red-White Valve Corporation.
  - l. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - m. Zy-Tech Global Industries, Inc.
2. Description:

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- a. Standard: MSS SP-70, Type I.
- b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
- c. NPS 14 to NPS 24, CWP Rating: 150 psig.
- d. Body Material: ASTM A 126, gray iron with bolted bonnet.
- e. Ends: Flanged.
- f. Trim: Bronze.
- g. Disc: Solid wedge.
- h. Packing and Gasket: Asbestos free.

**2.6 BRONZE GLOBE VALVES**

**A. Class 150, Bronze Globe Valves with Nonmetallic Disc:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Hammond Valve.
  - c. Kitz Corporation.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Powell Valves.
  - g. Red-White Valve Corporation.
  - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - i. Zy-Tech Global Industries, Inc.
- 2. Description:
  - a. Standard: MSS SP-80, Type 2.
  - b. CWP Rating: 300 psig.
  - c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
  - d. Ends: Threaded.
  - e. Stem: Bronze.
  - f. Disc: PTFE or TFE.
  - g. Packing: Asbestos free.
  - h. Handwheel: Malleable iron.

**2.7 IRON GLOBE VALVES**

**A. Class 125, Iron Globe Valves:**

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Crane Co.; Crane Valve Group; Crane Valves.
  - b. Crane Co.; Crane Valve Group; Jenkins Valves.
  - c. Crane Co.; Crane Valve Group; Stockham Division.
  - d. Hammond Valve.
  - e. Kitz Corporation.
  - f. Milwaukee Valve Company.
  - g. NIBCO INC.

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- h. Powell Valves.
  - i. Red-White Valve Corporation.
  - j. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - k. Zy-Tech Global Industries, Inc.
2. Description:
- a. Standard: MSS SP-85, Type I.
  - b. CWP Rating: 200 psig.
  - c. Body Material: ASTM A 126, gray iron with bolted bonnet.
  - d. Ends: Flanged.
  - e. Trim: Bronze.
  - f. Packing and Gasket: Asbestos free.

**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 check valves for proper direction of flow and as follows:
  - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.3 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.4 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
  - 1. Shutoff Service: Ball or gate valves.
  - 2. Throttling Service except Steam: Globe, angle or ball valves.
  - 3. Pump-Discharge Check Valves:
    - a. NPS 2 and Smaller: Bronze swing check valves with bronze or nonmetallic disc.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
  - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
  - 2. For Steel Piping, NPS 2 and Smaller: Threaded ends.
  - 3. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.5 DUAL TEMPERATURE-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: Three piece, full port, brass with stainless-steel trim.
  - 3. Bronze Swing Check Valves: Class 150, bronze disc.
  - 4. Bronze Gate Valves: Class 150, RS.
  - 5. Bronze Globe Valves: Class 150, bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
  - 1. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
  - 2. Iron Swing Check Valves: Class 125, metal seats.
  - 3. Iron Gate Valves: Class 125, OS&Y.
  - 4. Iron Globe Valves, NPS 2-1/2 to NPS 12: Class 125.

END OF SECTION

SECTION 23 05 29  
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following hangers and supports for mechanical system piping and equipment:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Pipe stands.
  - 7. Equipment supports.
- B. Related Sections include the following:
  - 1. Division 23 Section "Mechanical Vibration Controls" for vibration isolation devices.
  - 2. Division 23 Section Metal Ducts for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.4 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems and system contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 SUBMITTALS

- A. Product Data: For the following:

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1. Pipe hangers and supports.
2. Equipment supports.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

**2.2 STEEL PIPE HANGERS AND SUPPORTS**

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Available Manufacturers:
1. B-Line Systems, Inc.; a division of Cooper Industries.
  2. Carpenter & Paterson, Inc.
  3. Empire Industries, Inc.
  4. ERICO/Michigan Hanger Co.
  5. Globe Pipe Hanger Products, Inc.
  6. Grinnell Corp.
  7. GS Metals Corp.
  8. National Pipe Hanger Corporation.
  9. PHD Manufacturing, Inc.
  10. PHS Industries, Inc.
  11. Piping Technology & Products, Inc.
- C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.
- D. Nonmetallic Coatings: Plastic coating, jacket, or liner.
- E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

**2.3 TRAPEZE PIPE HANGERS**

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

**2.4 THERMAL-HANGER SHIELD INSERTS**

- A. Description: 100-psig- minimum, compressive-strength insulation insert encased in sheet metal shield.

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- B. Available Manufacturers:
  - 1. Carpenter & Paterson, Inc.
  - 2. ERICO/Michigan Hanger Co.
  - 3. PHS Industries, Inc.
  - 4. Pipe Shields, Inc.
  - 5. Rilco Manufacturing Company, Inc.
  - 6. Value Engineered Products, Inc.
- C. Insulation-Insert Material for Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

**PART 3 - EXECUTION**

**3.1 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  - 1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes.
  - 2. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
  - 3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
  - 4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
  - 5. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
  - 6. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.

7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  8. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
  9. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
  10. Extension Hinged or 2-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
  11. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
- F. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- G. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
  2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
- H. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  2. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  3. C-Clamps (MSS Type 23): For structural shapes.
  4. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  5. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
  6. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
  7. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
- I. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- J. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.



### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Provide all supplemental steel necessary to support equipment and piping from building structure. Use structural steel angles and shapes to span existing structure. Bolt or weld supplemental steel to existing structure.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 are not exceeded.
- K. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.9.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
    - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:
  - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Provide all supplemental steel necessary to support equipment and piping.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing or cables, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

### 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

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- B. Touch Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 painting Sections.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 23 05 53  
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Pipe labels.
3. Stencils.
4. Valve tags.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Valve numbering scheme.
- C. Valve Schedules: For each piping system to include in maintenance manuals.

1.3 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: Black.
3. Background Color: White.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

- B. Label Content: Include equipment's Drawing designation number.

## 2.2 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- B. Adhesive Pipe Labels: Adhesive film type labels with full circumference flow arrows.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.
1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
  2. Lettering Size: At least 1-1/2 inches high.

## 2.3 STENCILS

- A. Stencils: Prepared with minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
1. Stencil Material: Fiberboard or metal.
  2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
  3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.
  4. Ductwork stencil shall indicate system number.

## 2.4 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.

1. Valve-tag schedule shall be included in operation and maintenance data.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

#### 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment. Each items of equipment listed in the equipment schedules shall be provided with an equipment label.
- B. Locate equipment labels where accessible and visible.

#### 3.3 PIPE LABEL INSTALLATION

- A. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 20 feet along each run.
- B. Pipe Label Color Schedule:
  1. Dual Temperature Water Piping:
    - a. Background Color: Red.
    - b. Letter Color: White.

#### 3.4 DUCT LABEL INSTALLATION

- A. Stenciled Duct Label Option: Stenciled labels or stencil directly on ductwork, showing service and flow direction. Label ductwork as follows:
  1. EXHAUST AIR
  2. SUPPLY AIR
  3. RETURN AIR
- B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 20 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:
  - 1. Valve-Tag Size:
    - a. Dual Temperature Water: 1-1/2 inches
  - 2. Valve-Tag Color:
    - a. All: Brass.
  - 3. Letter Color:
    - a. All: Black.

END OF SECTION

SECTION 23 05 93  
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:

1. Balancing Air Systems:
  - a. Constant-volume air systems.
  - b. Dual deck duct systems.
2. Balancing Hydronic Piping Systems:
  - a. Constant-flow hydronic systems.
3. Testing, Adjusting, and Balancing Equipment:
  - a. Motors.
  - b. Heat-transfer coils.
4. Testing, adjusting, and balancing existing systems and equipment. Balancing is required for all equipment in the area of work. Balancing is required for duct systems throughout the three floors of the project.
5. Duct leakage tests.
6. Control system verification.
7. Measurement of core system duct air flows before start of construction.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.



- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Certified TAB reports.

#### 1.5 QUALITY ASSURANCE

- A. TAB Specialists Qualifications: Certified by AABC NEBB or TABB.
  - 1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC, NEBB or TABB.
  - 2. TAB Technician: Employee of the TAB specialist and certified by AABC, NEBB or TABB as a TAB technician.
- B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

#### 1.6 FIELD CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### PART 2 - PRODUCTS (Not Applicable)

#### PART 3 - EXECUTION

##### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- B. Examine installed systems for balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify

that locations of these balancing devices are applicable for intended purpose and are accessible.

- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
  - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
  - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as fan coil units, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.
- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine operating safety interlocks and controls on HVAC equipment.
- O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes the following:
  - 1. Equipment and systems to be tested.
  - 2. Strategies and step-by-step procedures for balancing the systems.
  - 3. Instrumentation to be used.
  - 4. Sample forms with specific identification for all equipment.
  
- B. Measure supply, return and exhaust air flows at each floor at the duct mains.
  
- C. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
  - 1. Airside:
    - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
    - b. Duct systems are complete with terminals installed.
    - c. Volume, smoke, and fire dampers are open and functional.
    - d. Clean filters are installed.
    - e. Fans are operating, free of vibration, and rotating in correct direction.
    - f. Variable-frequency controllers' startup is complete and safeties are verified.
    - g. Automatic temperature-control systems are operational.
    - h. Ceilings are installed.
    - i. Windows and doors are installed.
    - j. Suitable access to balancing devices and equipment is provided.
  
  - 2. Hydronics:
    - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
    - b. Piping is complete with terminals installed.
    - c. Water treatment is complete.
    - d. Systems are flushed, filled, and air purged.
    - e. Strainers are pulled and cleaned.
    - f. Control valves are functioning per the sequence of operation.
    - g. Shutoff and balance valves have been verified to be 100 percent open.
    - h. Suitable access to balancing devices and equipment is provided.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.
  
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 233300 "Air Duct Accessories."
  3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and Section 230719 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (IP) units.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Balance all outlets and inlets to air quantities indicated. Both existing and new components are to be balanced.
- B. Vertical fan coil units and unit ventilators are to be balanced to provide the outdoor air quantity indicated. All such units in the areas of work are to be balanced.
- C. Prepare test reports for both duct mains and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.
- D. Prepare schematic diagrams of systems' "as-built" duct layouts.
- E. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- F. Check airflow patterns from the mixing dampers.
- G. Check dampers for proper position to achieve desired airflow path.
- H. Check for airflow blockages.
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air-handling-unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.
    - a. Balance core air systems at both full hot deck and full cold deck air flows.
    - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
    - c. If a reliable Pitot-tube traverse is not possible, measure airflow at terminals and calculate the total airflow.
  2. Measure static pressures as follows:
    - a. Measure static pressure directly at the ducted fan coil unit outlet or through the flexible connection.
    - b. Measure static pressure directly at the ducted fan coil unit inlet or through the flexible connection.
    - c. Measure static pressure at the hot and cold deck main on each floor.
  3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
  2. Adjust submain and branch duct volume dampers for specified airflow.
  3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
  2. Measure inlets and outlets airflow.
  3. Adjust each inlet and outlet for specified airflow.
  4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
  2. Re-measure and confirm that total airflow is within design.
  3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
  4. Mark all final settings.
  5. Test system in economizer mode. Verify proper operation and adjust if necessary.
  6. Measure and record all operating data.
  7. Record final fan-performance data.

### 3.6 PROCEDURES FOR FAN COIL UNITS AND UNIT VENTILATORS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer. Adjust the outside air dampers to provide the required minimum outside air scheduled when in open position. If fan speed results in objectionable noise, reduce the fan speed and rebalance the outside air damper as necessary.

### 3.7 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for coils, including existing coils, in areas of work. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil flow rates with floor design flow rates.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
  - 1. Check flow-control valves for proper position.
  - 2. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
  - 3. Verify that motor starters are equipped with properly sized thermal protection.
  - 4. Check that air has been purged from the system.

### 3.8 PROCEDURES FOR CONSTANT-FLOW HYDRONIC SYSTEMS

- A. Measure total water flow per floor.
  - a. Position valves for full flow through coils.
  - b. Measure flow by clamp-on flow meter.
- B. Adjust flow-metering devices installed in piping and at terminal units to design water flows.
  - 1. Measure flow in main and branch pipes.
  - 2. Adjust main and branch balance valves for design flow.
  - 3. Re-measure each main and branch after all have been adjusted.
- C. Adjust flow-measuring devices installed at terminals for each space to design water flows.
  - 1. Measure flow at terminals.
  - 2. Adjust each terminal to design flow.
  - 3. Re-measure each terminal after it is adjusted.
  - 4. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
  - 5. Perform temperature tests after flows have been balanced.
- D. For systems with pressure-independent valves at terminals:
  - 1. Measure differential pressure and verify that it is within manufacturer's specified range.

2. Perform temperature tests after flows have been verified.
- E. For systems without pressure-independent valves or flow-measuring devices at terminals:
  1. Measure and balance coils by clamp-on flow meter.
- F. Verify final system conditions as follows:
  1. Re-measure and confirm that total water flow per floor is as per design.
  2. Mark final settings.
- G. Verify that memory stops have been set.

### 3.9 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each water coil:
  1. Entering- and leaving-water temperature.
  2. Water flow rate.
  3. Dry-bulb temperature of entering and leaving air.
  4. Wet-bulb temperature of entering and leaving air for cooling coils.
  5. Airflow.
- B. Measure, adjust, and record the following data for each refrigerant coil:
  1. Dry-bulb temperature of entering and leaving air.
  2. Wet-bulb temperature of entering and leaving air.
  3. Airflow.

### 3.10 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

### 3.11 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
  1. Verify temperature control system is operating within the design limitations.
  2. Confirm that the sequences of operation are in compliance with Contract Documents.
  3. Verify that controllers are calibrated and function as intended.
  4. Verify that controller set points are as indicated.
  5. Verify the operation of lockout or interlock systems.

6. Verify the operation of valve and damper actuators.
7. Verify that controlled devices are properly installed and connected to correct controller.
8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.

- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

### 3.12 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment and systems that are to remain and be reused.

1. Measure and record the airflow, and static pressure in the hot and cold deck takeoffs at each floor.
2. Check the condition of equipment coils.
3. Check the operation of the drain pan and condensate-drain trap.
4. Check bearings and other lubricated parts for proper lubrication.
5. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
6. Indicate where balancing devices are missing or damaged such that complete balancing is not feasible. Provide a written report itemizing repairs and new devices needed to assure proper air and water flows.

- B. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment is operational. Verify the following:

1. New filters are installed.
2. Coils are clean and fins combed.
3. Drain pans are clean.
4. Fans are clean.
5. Bearings and other parts are properly lubricated.
6. Deficiencies noted in the preconstruction report are corrected.

- C. Perform testing and balancing of existing systems as indicated on the drawings and these specifications.

1. Compare the indicated airflow of the renovated work to the measured available airflows.
2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
3. If calculations increase or decrease the airflow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
4. Balance each air outlet to air quantities shown.
5. Balance water flow quantities to rates shown.



6. Measure air and water flows at each item of equipment in the areas of work, including, but not limited to:
  - a. Existing fan coil units.
  - b. Existing unit ventilators.
  - c. Floor hot and cold duct air flows.

### 3.13 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
  1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
  2. Air Outlets and Inlets: Plus or minus 5 percent.
  3. Dual Temperature-Water Flow Rate: Plus or minus 5 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

### 3.14 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of existing balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

### 3.15 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  2. Include a list of instruments used for procedures, along with proof of calibration.
  3. Certify validity and accuracy of field data.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  1. Fan curves.
  2. Manufacturers' test data.
  3. Field test reports prepared by system and equipment installers.
  4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  1. Title page.
  2. Name and address of the TAB specialist.

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3. Project name.
  4. Project location.
  5. Architect's name and address.
  6. Engineer's name and address.
  7. Contractor's name and address.
  8. Report date.
  9. Signature of TAB supervisor who certifies the report.
  10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  12. Nomenclature sheets for each item of equipment.
  13. Data for terminal units, including manufacturer's name, type, size, and fittings.
  14. Notes to explain why certain final data in the body of reports vary from indicated values.
  15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Fan coil unit and Unit Ventilator Test Reports: For existing and new Fan Coil Units and Unit Ventilators, include the following:
1. Unit Data:
    - a. Unit identification.
    - b. Location.
    - c. Make and type.
    - d. Model number and unit size.
  2. Test Data (Indicated and Actual Values):
    - a. Total airflow rate in cfm.

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- b. Fan rpm.
- c. Discharge static pressure in inches wg.
- d. Filter static-pressure differential in inches wg.
- e. Cooling-coil static-pressure differential in inches wg.
- f. Heating-coil static-pressure differential in inches wg.
- g. Outdoor airflow in cfm.
- h. Return airflow in cfm.
- i. Outdoor-air damper position.
- j. Return-air damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
- b. Location.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Average face velocity in fpm.
- c. Air pressure drop in inches wg.
- d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
- e. Return-air, wet- and dry-bulb temperatures in deg F.
- f. Entering-air, wet- and dry-bulb temperatures in deg F.
- g. Leaving-air, wet- and dry-bulb temperatures in deg F.
- h. Water flow rate in gpm.
- i. Water pressure differential in feet of head or psig.
- j. Entering-water temperature in deg F.
- k. Leaving-water temperature in deg F.

G. System-Coil Reports: For water coils of terminal units, include the following:

1. Unit Data:

- a. System and air-handling-unit identification.
- b. Location and zone.
- c. Room or riser served.
- d. Coil make and size.
- e. Flowmeter type.

2. Test Data (Indicated and Actual Values):

- a. Airflow rate in cfm.
- b. Water flow rate, in gpm
- c. Entering-water temperature in deg F.
- d. Leaving-water temperature in deg F.
- e. Water pressure drop in feet of head or psig.
- f. Entering-air temperature in deg F.
- g. Leaving-air temperature in deg F.

H. Instrument Calibration Reports:

1. Report Data:
  - a. Instrument type and make.
  - b. Serial number.
  - c. Application.
  - d. Dates of use.
  - e. Dates of calibration.

3.16 VERIFICATION OF TAB REPORT

- A. Engineer may randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to 10 percent of the total measurements recorded.
- B. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
- C. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- D. If TAB work fails, proceed as follows:
  1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  2. If the second final inspection also fails, Owner may contract the services of another TAB specialist to complete TAB work according to the Contract Documents and deduct the cost of the services from the original TAB specialist's final payment.
  3. If the second verification also fails, design professional may contact AABC Headquarters regarding the AABC National Performance Guaranty.
- E. Prepare test and inspection reports.

END OF SECTION

SECTION 23 07 13  
DUCT INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply, return and outdoor air.
  - 2. Indoor, exposed supply, return and outdoor air.
  - 3. Indoor, exhaust air.
- B. Related Sections:
  - 1. Division 23 Section "HVAC Piping Insulation."
  - 2. Division 23 Section "Metal Ducts" for duct liners.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied, if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.
- B. Store where insulation will not be damaged or become wet.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
    - a. CertainTeed Corp.; SoftTouch Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Friendly Feel Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; SOFTR All-Service Duct Wrap.
- D. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide

insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. CertainTeed Corp.; Commercial Board.
  - b. Fibrex Insulations Inc.; FBX.
  - c. Johns Manville; 800 Series Spin-Glas.
  - d. Knauf Insulation; Insulation Board.
  - e. Manson Insulation Inc.; AK Board.
  - f. Owens Corning; Fiberglas 700 Series.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. 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).
  3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.
- C. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
    - d. Mon-Eco Industries, Inc.; 22-25.
  2. 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).

3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

## 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following]:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    - b. Eagle Bridges - Marathon Industries; 550.
    - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    - d. Mon-Eco Industries, Inc.; 55-50.
    - e. Vimasco Corporation; WC-1/WC-5.
  2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: 60 percent by volume and 66 percent by weight.
  5. Color: White.

## 2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:



1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
  - b. Eagle Bridges - Marathon Industries; 405.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
  - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

**B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:**

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

**2.5 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.
  3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.6 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 491 AWF FSK.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
    - c. Compac Corporation; 110 and 111.
    - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
  2. Width: 3 inches.
  3. Thickness: 6.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
  2. Width: 2 inches.
  3. Thickness: 3.7 mils.
  4. Adhesion: 100 ounces force/inch in width.
  5. Elongation: 5 percent.
  6. Tensile Strength: 34 lbf/inch in width.

## 2.7 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CHP-1.
    - 2) GEMCO; Cupped Head Weld Pin.
    - 3) Midwest Fasteners, Inc.; Cupped Head.
    - 4) Nelson Stud Welding; CHP.
3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.

- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

#### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.

- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  - 1. Comply with requirements in Division 07 Section "Penetration Firestopping" firestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
  - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 INSTALLATION OF MINERAL-FIBER INSULATION

- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
  - 1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  - 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  - 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  - 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

- b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
  5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
  3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not overcompress insulation during installation.
    - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface.

Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.6 FIELD-APPLIED JACKET INSTALLATION

- A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
  1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
  2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
  3. Completely encapsulate insulation with coating, leaving no exposed insulation.

### 3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  1. Indoor, concealed supply and outdoor air.
  2. Indoor, exposed supply and outdoor air.
  3. Indoor, concealed return.
  4. Indoor, exposed return.
  5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
  6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
- B. Items Not Insulated:



1. Metal ducts with duct liner of sufficient thickness to comply with ASHRAE/IESNA 90.1 and of equivalent R-value to exterior insulation specified.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.

### 3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed supply-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and .75-lb/cu. ft. nominal density.
- B. Concealed outdoor-air intake duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and .75-lb/cu. ft. nominal density.
- C. Concealed exhaust-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and .75-lb/cu. ft. nominal density.
- D. Concealed return-air duct insulation shall be the following:
  1. Mineral-Fiber Blanket: 1-1/2 inches thick and .75-lb/cu. ft. nominal density.
- E. Exposed supply, return, exhaust and outdoor-air plenum duct insulation shall be the following:
  1. Mineral-Fiber Board: 1-1/2 inches thick and 3-lb/cu. ft. nominal density.
  2. Areas requiring board insulation include, but is not limited to, the following:
    - a. All areas where ductwork is exposed to view.

END OF SECTION

SECTION 23 07 19  
HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Condensate drain piping, indoors.
  - 2. Dual temperature-water piping, indoors.
- B. Related Sections:
  - 1. Division 23 Section "Duct Insulation."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 3. Detail removable insulation at piping specialties.
  - 4. Detail application of field-applied jackets.
  - 5. Detail application at linkages of control devices.
- C. Qualification Data: For qualified Installer.
- D. 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.
- E. Field quality-control reports.

#### 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

#### 1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

#### 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.

### PART 2 - PRODUCTS

#### 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Piping Insulation Schedule" article for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Fibrex Insulations Inc.; Coreplus 1200.

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- b. Johns Manville; Micro-Lok.
  - c. Knauf Insulation; 1000-Degree Pipe Insulation.
  - d. Manson Insulation Inc.; Alley-K.
  - e. Owens Corning; Fiberglas Pipe Insulation.
2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- D. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
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. Aeroflex USA Inc.; Aerocel.
  - b. Armacell LLC; AP Armaflex.
  - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

**2.2 ADHESIVES**

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, provide one of the following:
- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
  - b. Eagle Bridges - Marathon Industries; 225.
  - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
  - d. Mon-Eco Industries, Inc.; 22-25.
2. 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).
3. Use adhesive that complies with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

**2.3 MASTICS**

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
  - b. Vimasco Corporation; 749.
2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

## 2.4 SEALANTS

### A. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers," including 2004 Addenda.

## 2.5 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-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

## 2.6 TAPES

### A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ABI, Ideal Tape Division; 428 AWF ASJ.
  - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
  - c. Compac Corporation; 104 and 105.
  - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

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2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

**2.7 SECUREMENTS**

**A. Bands:**

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.

**B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.**

**C. Wire: 0.062-inch soft-annealed, galvanized steel.**

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. C & F Wire.

**2.8 FIELD-APPLIED JACKETS**

**A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.**

**B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.**

**C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.**

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Johns Manville; Zeston.
  - b. P.I.C. Plastics, Inc.; FG Series.
  - c. Proto PVC Corporation; LoSmoke.
  - d. Speedline Corporation; SmokeSafe.
2. Adhesive: As recommended by jacket material manufacturer.
3. Color: White.
4. 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.
5. Factory-fabricated tank heads and tank side panels.
- D. Metal Jacket:
  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. Childers Products, Division of ITW; Metal Jacketing Systems.
    - b. PABCO Metals Corporation; Surefit.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
    - a. Provide Moisture Barrier for Outdoor Applications.
    - b. Factory-Fabricated Fitting Covers:
      - 1) Same material, finish, and thickness as jacket.
      - 2) Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
      - 3) Tee covers.
      - 4) Flange and union covers.
      - 5) End caps.
      - 6) Beveled collars.
      - 7) Valve covers.
      - 8) Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  1. Verify that systems to be insulated have been tested and are free of defects.
  2. Verify that surfaces to be insulated are clean and dry.
  3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
  - 1. Draw jacket tight and smooth.
  - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  - 3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.



4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.4 PENETRATIONS

- A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Division 07 Section "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- C. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 Section "Penetration Firestopping."

### 3.5 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.

2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
  3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.6 INSTALLATION OF MINERAL-FIBER INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

**New Jersey City University: Nursing Education Center  
Renovations to Rossey Hall**

2039 John F. Kennedy Boulevard  
Jersey City, NJ 07305

**Clarke Caton Hintz  
Construction Documents**

December 4, 2017

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. The requirements for dual temperature piping also apply to systems which operate in heating mode only.

3.9 INDOOR PIPING INSULATION SCHEDULE

- A. Condensate and Equipment Drain Water below 60 Deg F:
  - 1. All Pipe Sizes: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
- B. Dual Temperature-Water Supply and Return:
  - 1. Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe, Type I: 1 ½ inches thick.

END OF SECTION

SECTION 23 09 00  
INSTRUMENTATION AND CONTROLS FOR HVAC

PART 1 – GENERAL

1.1 DESCRIPTION

- A. General: The Building Automation System (BAS) shall be as indicated on the drawings and described in the specifications.
- B. The control system shall be of a high speed, peer-to-peer network of DDC controllers which will communicate with the existing operator workstations currently installed in the facility.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Division 26 Section "Fire Alarm" for fire and smoke detectors mounted in HVAC systems and equipment.
- C. Division 23 Section "Sequence of Operation" for requirements that relate to this Section.
- D. See also individual equipment specifications sections for controls requirements specific to equipment specified.

1.3 APPROVED CONTROL SYSTEM

- A. The following are the approved Control System manufacturers:
  - 1. Andover Continuum by The Tri-M Group, LLC
- B. The Contractor shall use only products from the corresponding manufacturer and product line listed.
- C. The above acceptable manufacturer applies to controller software, the custom application programming language, Ethernet Network Controllers and Standalone Digital Control Units. All other products specified herein (e.g., sensors, valves, dampers, and actuators) need not be manufactured by the above manufacturer.

1.4 QUALITY ASSURANCE

- A. Contractor/Manufacturer Qualifications
  - 1. The automatic temperature control system shall be provided and installed by Tri-M Building Automation Systems representing Andover Controls as an extension of the existing building automation systems installed on campus. Contact: Rob Koenig, Telephone (610) 444-1002 ext. 353 or rkoenig@tri-mgroup.com.
  - 2. The contractor shall have an established working relationship with the Control System Manufacturer of not less than thirty (30) years.
  - 3. The contractor shall provide 24-hour response in the event of a service emergency including a comprehensive inventory of controllers and control devices.

4. Scope of work: This contractor shall provide a complete control system addition to the existing Andover Continuum Control System installed on the New Jersey City University main campus. Except as otherwise noted, the control system shall consist of all communication hardware and software, Network Controllers, Standalone Digital Control Units, software, sensors, transducers, relays, valves, damper operators, control panels, and other accessory equipment, along with a complete system of electrical interlocking wiring to fill the intent of the specification and provide for a complete and operable system. Except as otherwise specified, provide actuators for equipment such as dampers. Coordinate requirements with the various Contractors.
5. The BAS contractor shall review and study all HVAC drawings and the entire specification to gain familiarity with the equipment and system operation and to verify the quantities and types of valves, actuators, alarms, etc. to be provided.
6. Provide wiring for the Input / Output points (I/O) designated and provide other wiring specifically included by this contract. When the BAS system is fully installed and operational, the BAS Contractor and representatives of the Owner will review and check out the system. At that time, the BAS contractor shall demonstrate the operation of the system and prove that it complies with the intent of the drawings and specifications.
7. The Contractor shall furnish and install a complete building automation system addition. At a minimum, provide the specified controls as detailed by the sequence of operations. Other control is as specified in the equipment and other sections of this document.
8. Provide services and manpower necessary for commissioning of system in coordination with the HVAC Contractor, Balancing Contractor and Owner's representative.
9. All work performed under this section of the specifications will comply with all codes, laws and governing bodies. If the drawings and/or specifications are in conflict with governing codes, the Contractor shall submit a proposal with appropriate modifications to the project to meet code requirements. If this specification and associated drawings exceed governing code requirements, the specification will govern. The Contractor shall obtain and pay for all necessary construction permits and licenses.

#### 1.5 CODES AND STANDARDS

- A. Provide BAS components and ancillary equipment, which are UL-916 listed and labeled.
- B. All equipment or piping used in conditioned air streams, spaces or return air plenums shall comply with NFPA 90A Flame/Smoke/Fuel contribution rating of 25/50/0 and all applicable building codes or requirements.
- C. All wiring shall conform to the National Electrical Code.
- D. All smoke dampers shall be rated in accordance with UL 555S.
- E. Comply with FCC rules, Part 15 regarding Class A radiation for computing devices and low power communication equipment operating in commercial environments.
- F. Comply with FCC, Part 68 rules for telephone modems and data sets.

#### 1.6 SYSTEM PERFORMANCE

- A. The system performance shall conform to the following:
  1. Graphic Display: The system shall display a graphic with 20 dynamic points with all current data within ten seconds.

2. Graphic Refresh: The system shall update a graphic with 20 dynamic points with all current data within eight seconds.
3. Object Command: The maximum time between the command of a binary object by the operator and the reaction by the device shall be less than two seconds. Analog objects should start to adjust within two seconds.
4. Object Scan: All changes of state and change of analog values will be transmitted over the high speed network such that any data used or displayed at a controller or workstation will have been current within the previous six seconds.
5. Alarm Response Time: The maximum time from when an object goes into alarm when it is annunciated at the workstation shall not exceed 45 seconds.
6. Program Execution Frequency: Custom and standard applications shall be capable of running as often as once every five seconds. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.
7. Performance: Programmable controllers shall be able to execute DDC PID control loops at a selectable frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.
8. Multiple Alarm Annunciation: All workstations on the network must receive alarms within five seconds of each other.

#### 1.7 SUBMITTALS

- A. All shop drawings shall be prepared in AutoCAD software. In addition to the drawings. Drawings shall be B size or larger.
- B. Shop drawings shall include a riser diagram depicting locations of all controllers and workstations, with associated network wiring. Also included shall be individual schematics of each mechanical system showing all connected points with reference to their associated controller. Typical drawings will be allowed where appropriate.
- C. Submittal data shall contain manufacturer's data on all hardware and software products required by the specification. Valve, damper and air flow station schedules shall indicate size, configuration, capacity and location of all equipment.
- D. Submit five (5) copies of submittal data and shop drawings to the Engineer for review prior to ordering or fabrication of the equipment. The Contractor prior to submitting shall check all documents for accuracy.
- E. The Engineer will make corrections, if required, and return to the Contractor. The Contractor will then resubmit with the corrected or additional data. This procedure shall be repeated until all corrections are made to the satisfaction of the Engineer and the submittals are fully approved.

#### 1.8 PROJECT RECORD DOCUMENTS

- A. The operation and maintenance manuals shall contain all information necessary for the operation, maintenance, replacement, installation, and parts procurement for the entire BAS. This documentation shall include specific part numbers and software versions and dates. A

complete list of recommended spare parts shall be included with the lead time and expected frequency of use of each part clearly identified.

- B. Following project completion and testing, the BAS contractor will submit as-built drawings reflecting the exact installation of the system. The as-built documentation shall also include a copy of all application software both in written form and on diskette.

#### 1.9 TRAINING

- A. Provide a minimum of 8 hours of on-site training for personnel designated by the Owner.
- B. Train the designated staff of Owner's Representative and Owner to enable them to do the following:

##### Day-to-Day Operators:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand DDC system components.
4. Understand system operation, including DDC system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log on and off the system.
7. Access graphics, point reports, and logs.
8. Adjust and change system setpoints, time schedules, and holiday schedules.
9. Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.
10. Understand system drawings and Operation and Maintenance manual.
11. Understand the job layout and location of control components.

#### 1.11 WARRANTY

- A. Warrant all work as follows:
  1. The BAS contractor shall warrant the system for 12 months after system acceptance and beneficial use by the owner. During the warranty period, the BAS contractor shall be responsible for all necessary revisions to the software as required to provide a complete and workable system consistent with the letter and intent of the Sequence of Operation section of the specification. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The Contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.
  2. All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system startup. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period.

### PART 2 – PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Andover Continuum by The Tri-M Group, LLC

#### 2.2 NETWORK COMMUNICATION



A. SYSTEM ARCHITECTURE

The Building Automation System (BAS) shall consist of Network Control Units (NCUs), a family of Standalone Digital Control Units (SDCUs), Input/Output Unit Modules (IOU Modules), Operator Workstations (OWs), and one File Server to support system configurations where more than one operator workstation is required. The BAS shall provide control, alarm detection, scheduling, reporting and information management for the entire facility, and Wide Area Network (WAN) if applicable, from a single ODBC-compliant database.

B. LEVEL 1 NETWORK DESCRIPTION

Level 1, the main backbone of the system, shall be an Ethernet LAN/WAN. Network Control Units, Operator Workstations, and the Central File Server shall connect directly to this network without the need for Gateway devices.

C. LEVEL 2 NETWORK DESCRIPTION

Level 2 of the system shall consist of one or more field buses managed by the Network Control Units. The Level 2 field buses may consist of one or both of the following types:

1. An RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC equipment and lighting, or
2. An RS485 field bus that supports up to 32 devices from a family of plug-in, IOU modules.

These IOU modules may be mounted within the NCU enclosure or remotely mounted via a single, twisted, shielded pair of wires.

D. BAS

The BAS shall be capable of being segmented, through software, into multiple local area networks (LANs) distributed over a wide area network (WAN), sharing a single file server. This enables workstations to manage a single LAN (or building), and/or the entire system with all devices being assured of being updated by and sharing the most current database. In the case of a single workstation system, the workstation shall contain the entire database – with no need for a separate file server.

E. STANDARD NETWORK SUPPORT

All NCUs, Workstation(s) and File Server shall be capable of residing directly on the Owner's Ethernet TCP/IP LAN/WAN with no required gateways. Furthermore, the NCU's, Workstation(s) and File Server shall be capable of using standard, commercially available, off-the-shelf Ethernet infrastructure components such as routers, switches and hubs. With this design the Owner may utilize the investment of an existing or new enterprise network or structured cabling system. This also allows the option of the maintenance of the LAN/WAN to be performed by the owner's Information Systems Department as all devices utilize standard TCP/IP components.

F. REMOTE COMMUNICATIONS

In addition to the above LAN/WAN architecture support, the same workstation software (front end) must be capable of managing remote systems via standard dial-up phone lines as a standard component of the software. Front-end "add-on" software modules to perform remote site communication shall not be acceptable.

The remote system architecture shall consist of two levels providing control, alarm detection, reporting and information management for the remote facility. Level 1 shall contain the Remote Site Control Unit, communicating to the remotely located, Operator Workstation(s) through the use of a modem and a standard dial-up phone line. Level 2 shall consist of one or more field buses controlled by the RSCU. The field buses may consist of one or both of two types:

1. An RS485, token passing bus that supports up to 127 Standalone Digital Control Units (SDCUs) for operation of HVAC equipment and lighting, or
2. An RS485 field bus that supports up to 32 devices from a family of plug-in, IOU modules that may be mounted within the RSCU enclosure or remotely mounted on a single, twisted, shielded pair of wires.

#### G. SYSTEM EXPANSION

The BAS system shall be scalable and expandable at all levels of the system using the same software interface, and the same Level 1 and Level 2 controllers. Systems that require replacement of either the workstation software or field controllers in order to expand the system shall not be acceptable.

The BAS shall be expandable to include Security and Access Control functions at any time in the future with no additional workstations, front-end software or Level 1 controllers required. Standalone Digital Control Units or IOU modules shall be able to be added to the existing Level 1 controller's field bus, to perform security and card access applications.

The system shall use the same application programming language for all levels: Operator Workstation, Network Control Unit, Remote Site Control Unit and Standalone Digital Control Unit. Furthermore, this single programming language shall be used for all applications: environmental control, card access control, intrusion detection and security, lighting control, leak detection / underground storage tank monitoring, and digital data communication interfaces to third party microprocessor-based devices.

The system shall also provide the ability to program custom ASCII communication drivers that will reside in the NCU, for communication to third party systems and devices. These drivers will provide real time monitoring and control of the third party systems.

### 2.3 NETWORK CONTROL UNITS (NCUs)

#### A. GENERAL

Network Control Units shall be microprocessor based, multi-tasking, multi-user, and employ a real time operating system. Each NCU control panel shall consist of modular hardware including power supply, CPU board, and input/output modules. A sufficient number of NCUs shall be supplied to fully meet the requirements of this specification and the attached point list.

#### B. WEBSERVER FUNCTIONALITY

All NCUs on the Ethernet TCP/IP LAN/WAN shall be capable, out-of-the box, to be set up as a Web Server. The NCU shall have the ability to store HTML code and "serve" pages to a web browser. This provides the ability for any computing device utilizing a TCP/IP Ethernet connection and capable of running a standard Internet browser to access real-time data from the entire BAS via any NCUs.

Graphics and text-based web pages shall be constructed using standard HTML code. The interface shall allow the user to choose any of the standard text or graphics-based HTML editors for page creation. It shall also allow the operator to generate custom graphical pages and forms. The WEB server interface shall be capable of password security, including validation of the requesting PC's IP address. The WEB server interface shall allow the sharing of data or information between any controller, or process or network interface (BACnet, LonTalk and TCP/IP) that the BAS has knowledge of, regardless of where the point is connected on the BAS network or where it is acquired from.

The BAS network controller must act directly as the WEB server. It must directly generate the HTML code to the requesting user (i.e. WEB browser), eliminating the need for and reliance on any PC-based WEB server hardware or software. To simplify graphic image space allocation, HTML graphic images, if desired, shall be stored on any shared network device. The BAS WEB server shall have the ability to acquire any necessary graphics using standard pathing syntax within the HTML code mounted within the BAS WEB server.

### C. HARDWARE SPECIFICATIONS

#### 1. MEMORY:

A minimum of 4MB of RAM shall be provided for NCUs with expansion up to 8MB. The 8MB versions shall include a floating-point math co-processor.

#### 2. COMMUNICATION PORTS:

Each NCU shall provide communication to both the Workstation(s) and the field buses. In addition, each NCU must have at least 3 other communications ports that support a telephone modem, portable service tool, serial printer and connection to third party controllers such as a chiller control panel. On a LAN/WAN system the NCU shall be provided with a 10Mbps plug-in Ethernet TCP/IP network interface card (NIC).

#### 3. INPUT/OUTPUT (I/O):

Each NCU shall support the addition of the following types of inputs and outputs:

- a. Digital Inputs for status/alarm contacts
- b. Counter Inputs for summing pulses from meters.
- c. Thermistor inputs for measuring temperatures in space, ducts and thermowells.
- d. Analog inputs for pressure, humidity, flow and position measurements.
- e. Digital Outputs for on/off equipment control.
- f. Analog Outputs for valve and damper position control, and capacity control of primary equipment.

#### 4. MODULAR EXPANDABILITY:

The system shall employ a modular I/O design to allow easy expansion. Input and output capacity is to be provided through plug-in modules of various types or DIN-mountable IOU modules. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.

#### 5. HARDWARE OVERRIDE SWITCHES:

All digital output units shall include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit

and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.

6. LOCAL STATUS INDICATOR LAMPS:

Provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each output, provide LED indication of the value of the output (On/Off). For each output module provide an LED which gives a visual indication of whether any outputs on the module are manually overridden.

7. REAL TIME CLOCK (RTC):

Each NCU shall include a battery-backed, real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. In normal operation the system clock will be based on the frequency of the AC power. The system shall automatically correct for daylight savings time and leap years.

8. POWER SUPPLY:

The power supply for the NCUs shall be auto sensing, 120-220VAC, 60/50 Hz power, with a tolerance of +/- 20%. Line voltage below the operating range of the system shall be considered outages. The controller shall contain over voltage surge protection, and require no additional AC power signal conditioning. Optionally, if indicated on the drawings, the power supply shall accept an input voltage of (-48 VDC).

9. AUTOMATIC RESTART AFTER POWER FAILURE:

Upon restoration of power after an outage, the ECU shall automatically and without human intervention: update all monitored functions; resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

10. BATTERY BACKUP:

Each NCU with the standard 120-220VAC power supply shall include a programmable DC power backup system rated for a minimum of 72 hours of battery backup to maintain all volatile memory or, a minimum of 2 hours of full UPS including modem power. This power backup system shall be configurable such that at the end of a settable timeframe (such as 1 hour) of running on full UPS, the unit will shut off full UPS and switch to memory retention-only mode for the remainder of the battery power. The system shall allow the simple addition of more batteries to extend the above minimum battery backup times.

D. SOFTWARE SPECIFICATIONS

1. GENERAL.

The NCU shall contain flash ROM as the resident operating system. Application software will be RAM resident. Application software will only be limited by the amount of RAM memory. There will be no restrictions placed on the type of application programs in the system. Each NCU shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry,

printout of the program for storage, etc.

2. USER PROGRAMMING LANGUAGE:

The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be English language-based and programmable by the user. The language shall be structured to allow for the easy configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, passwords, and histories. The language shall be self-documenting. Users shall be able to place comments anywhere in the body of a program. Program listings shall be configurable by the user in logical groupings.

3. CONTROL SOFTWARE:

The NCU shall have the ability to perform the following pre-tested control algorithms:

- a. Proportional, Integral plus Derivative Control (PID)
- b. Self Tuning PID
- c. Two Position Control
- d. Digital Filter
- e. Ratio Calculator
- f. Equipment Cycling Protection

4. MATHEMATICAL FUNCTIONS:

Each controller shall be capable of performing basic mathematical functions (+, -, \*, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.

5. ENERGY MANAGEMENT APPLICATIONS:

NCUs shall have the ability to perform any or all of the following energy management routines:

- a. Time of Day Scheduling
- b. Calendar Based Scheduling
- c. Holiday Scheduling
- d. Temporary Schedule Overrides
- e. Optimal Start
- f. Optimal Stop
- g. Night Setback Control
- h. Enthalpy Switchover (Economizer)
- i. Peak Demand Limiting
- j. Temperature Compensated Duty Cycling
- k. CFM Tracking
- l. Heating/Cooling Interlock
- m. Hot/Cold Deck Reset
- n. Free Cooling

6. HISTORY LOGGING:

Each controller shall be capable of logging any system variable over user defined time

intervals ranging from 1 second to 1440 minutes. Any system variables (inputs, outputs, math calculations, flags, etc.) can be logged in history. A maximum of 32767 values can be stored in each log. Each log can record either the instantaneous, average, minimum or maximum value of the point. Logs can be automatic or manual. Logged data shall be downloadable to the Operator Workstation for long term archiving based upon user-defined time intervals, or manual command.

7. ALARM MANAGEMENT:

For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan of the NCU and can result in the display of one or more alarm messages or reports.

Up to 8 alarms can be configured for each point in the controller.

Messages and reports can be sent to a local terminal, to the front-end workstation, or via modem to a remote-computing device.

Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided.

If communication with the Operator Workstation is temporarily interrupted, the alarm will be buffered in the NCU. When communications return, the alarm will be transmitted to the Operator Workstation if the point is still in the alarm condition.

8. REPORTING.

The NCU shall be able to generate user-definable reports to a locally connected printer or terminal. The reports shall contain any combination of text and system variables. Report templates shall be able to be created by users in a word processing environment. Reports can be displayed based on any logical condition or through a user command.

2.4 STANDALONE DIGITAL CONTROL UNITS (SDCUs)

A. GENERAL:

Standalone Digital Control Units shall provide control of HVAC and lighting. Each controller shall have its own control programs and will continue to operate in the event of a failure or communication loss to its associated NCU.

B. MEMORY:

Control programs shall be stored in battery backed-up RAM and EPROM. Each controller shall have a minimum of 32K bytes of user RAM memory and 128K bytes of EPROM.

C. COMMUNICATION PORTS:

SDCUs shall provide a communication port to the field bus. In addition, a port shall be provided for connection of a portable service tool to support local commissioning and parameter changes with or without the NCU online. It shall be possible from a service port on any SDCU to view, enable/disable, and modify values of any point or program on any controller on the local field bus, any NCU or any SDCU on a different field bus.

D. INPUT/OUTPUT:

Each SDCU shall support the addition of the following types of inputs and outputs:

1. Digital Inputs for status/alarm contacts
2. Counter Inputs for summing pulses from meters.
3. Thermistor Inputs for measuring temperatures in space, ducts and thermowells.
4. Analog inputs for pressure, humidity, flow and position measurements.
5. Digital Outputs for on/off equipment control.
6. Analog Outputs for valve and damper position control, and capacity control of primary equipment.

E. EXPANDABILITY:

Input and output capacity shall be expandable through the use of plug-in modules. A minimum of two modules shall be added to the base SDCU before additional power is required.

F. NETWORKING:

Each SDCU will be able to exchange information on a peer to peer basis with other Standalone Digital Control Units during each field bus scan. Each SDCU shall be capable of storing and referencing global variables (on the LAN) with or without any workstations online. Each SDCU shall be able to have its program viewed and/or enabled/disabled either locally through a portable service tool or through a workstation connected to an NCU.

G. INDICATOR LAMPS:

SDCUs will have as a minimum, LED indication of CPU status, and field bus status.

H. REAL TIME CLOCK (RTC):

An SDCU shall have a real time clock in either hardware or software. The accuracy shall be within 10 seconds per day. The RTC shall provide the following information: time of day, day, month, year, and day of week. Each SDCU shall receive a signal, every hour, over the network from the NCU which synchronizes all SDCU real time clocks.

I. AUTOMATIC RESTART AFTER POWER FAILURE:

Upon restoration of power, the SDCU shall automatically and without human intervention, update all monitored functions, resume operation based on current, synchronized time and status, and implement special start-up strategies as required.

J. BATTERY BACK UP:

Each SDCU shall have at least 3 years of battery back up to maintain all volatile memory.

K. ALARM MANAGEMENT:

For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan of the SDCU and can result in the display of one or more alarm messages or reports.

Up to 8 alarms can be configured for each point in the controller enabling the escalation of the alarm priority (urgency) based upon which alarm(s) is/are triggered.

Alarm messages can be sent to a local terminal or modem connected to an NCU or to the

Operator's Workstation(s).

Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided.

If communication with the NCU is temporarily interrupted, the alarm will be buffered in the SDCU. When communications return, the alarm will be transmitted to the NCU if the point is still in the alarm condition.

#### L. UNITARY CONTROLLERS

1. Unitary Controllers shall support, but not be limited to, the control of the following systems as described in the Execution portion of this specification, and for future expansion:
  - a. Unit Ventilators
  - b. Fan Coils
2. The I/O of each Unitary Controller shall contain the sufficient quantity and types as required to meet the sequence of operation found in the Execution portion of this specification. In addition, each controller shall have the capability for time of day scheduling, occupancy mode control, after hour operation, lighting control, alarming, and trending.

#### M. DISPLAY CONTROLLERS

1. Display controllers are standalone, touch screen based operator interfaces. The controller shall be designed for flush mounting in a finished space, with a minimum display size of 9 x 9 inches.
2. Software shall be user programmable allowing for custom graphical images that simulate floor plans, menus, equipment schematics along with associated real time point values coming from any NCU on the network.
3. The touch screen display shall contain a minimum of 64 possible touch cells that permit user interaction for changing screens, modifying setpoints or operating equipment.
4. Systems that do not offer a display controller as specified must provide a panel mounted computer with touch screen capability as an alternative

### 2.5 AUXILIARY CONTROL DEVICES

A. Motorized control dampers, unless otherwise specified elsewhere, shall be as follows:

1. Control dampers shall be the parallel or opposed blade type as below or as scheduled on drawings.
  - a. Outdoor and/or return air mixing dampers and face and bypass (F&BP) dampers shall be parallel blade, arranged to direct airstreams toward each other.
  - b. Other modulating dampers shall be the opposed blade type.



- c. Two position shutoff dampers may be parallel or opposed blade type with blade and side seals.
  2. Damper frames shall be 13 gauge galvanized steel channel or 1/8 inch extruded aluminum with reinforced corner bracing.
  3. Damper blades shall not exceed 20 centimeters (eight inches) in width or 125 centimeters (48 inches) in length. Blades are to be suitable for medium velocity performance (2000 FPM). Blades shall be not less than 16 gauge.
  4. Damper shaft bearings shall be as recommended by manufacturer for application, oil impregnated sintered bronze or better.
  5. All blade edges and top and bottom of the frame shall be provided with replaceable butyl rubber or neoprene seals. Side seals shall be spring-loaded stainless steel. The blade seals shall provide for a maximum leakage rate of 10 CFM per square foot at four inches w.g. differential pressure. Provide air foil blades suitable for a wide-open face velocity of 1500 FPM.
  6. Individual damper sections shall not be larger than 48 inches by 60 inches. Provide a minimum of one damper actuator per section.
  7. Modulating dampers shall provide a linear flow characteristic where possible.
  8. Dampers shall have exposed linkages.
  9. Approved manufacturer: Ruskin or approved equal.
- B. Electric Damper/Valve Actuators
1. The actuator shall have mechanical or electronic stall protection to prevent damage to the actuator throughout the rotation of the actuator.
  2. Where shown, for power failure/safety applications, an internal mechanical, spring return mechanism shall be built into the actuator housing. Alternatively, an uninterruptible power supply (UPS) may be provided.
  3. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range.
  4. All 24 VAC/VDC actuators shall operate on Class 2 wiring.
  5. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 inches-pound torque capacity shall have a manual crank for this purpose.
  6. Approved manufacturer: Belimo
- C. Control Valves
1. Control valves shall be three way type for modulating service as shown.
  2. Close-off (Differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:

- a. Water Valves
    1. Two Way: 150 percent of total system (pump) head.
    2. Three Way: 300 percent of pressure differential between ports A and B at design flow or 100 percent of total system (pump) head.
  3. Water Valves
    - a. Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
    - b. Sizing Criteria
      1. Two Position Service: Line size.
      2. Two Way Modulating Service: Pressure drop shall be equal to 50 percent of the pressure difference between supply and return mains, or 5 PSI, whichever is greater.
      3. Three Way Modulating Service: Pressure drop equal to twice the pressure drop through the coil, 5 PSI maximum.
      4. Valves 1/2 inch through two inches shall be bronze body or cast brass ANSI Class 250, spring loaded, PTFE packing, quick opening for two position service. Two way valves to have replaceable composition disc or stainless steel ball.
    - c. Water valves shall fail normally open, as scheduled on plans, or as follows:
      1. Dual Temperature Coils: Normally open (flow through coil).
  4. Approved manufacturer: Belimo or approved equal.
- D. Binary Temperature Devices
1. Low voltage space thermostat shall be 24V, bimetal-operated, mercury switch type, with either adjustable or fixed anticipation heater, concealed setpoint adjustment, 55 degrees F to 85 degrees F setpoint range, 2 degrees F maximum differential, and vented ABS plastic cover.
  2. Line voltage space thermostat shall be bimetal-actuated, open contact type, or bellows-actuated, enclosed, snap switch type or equivalent solid state type, with heat anticipator, UL listed for electrical rating, concealed setpoint adjustment, 55 degrees F to 85 degrees F setpoint range, 2 degrees F maximum differential, and vented ABS plastic cover.
  3. Low Limit Thermostats: Low limit air stream thermostats shall be UL listed, vapor pressure type, with an element of 20 feet minimum length. Element shall respond to the lowest temperature sensed by any one foot section. The low limit thermostat shall be manual reset only.

E. Temperature Sensors

1. Temperature sensors shall be Resistance Temperature Device (RTD) or thermistor.
2. Duct sensors shall be single point or averaging as shown. Averaging sensors shall be a minimum of five feet in length per ten square feet of duct cross section.
3. Immersion sensors shall be provided with a separable stainless steel well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed. The well must withstand the flow velocities in the pipe.
4. Space sensors shall be equipped with setpoint adjustment, 2 hour (adjustable) override switch, temperature display, and communication port.
5. Provide matched temperature sensors for differential temperature measurement.

F. Humidity Sensors

1. Duct and room sensors shall have a sensing range of 20 percent to 80 percent.
2. Duct sensors shall be provided with a sampling chamber.
3. Outdoor air humidity sensors shall have a sensing range of 20 percent to 95 percent relative humidity. They shall be suitable for ambient conditions of -40 degrees F to 170 degrees F.
4. Humidity sensor's drift shall not exceed one percent of full scale per year.

G. Relays

1. Control relays shall be UL listed plug-in type with dust cover and LED "energized" indicator. Contact rating, configuration, and coil voltage shall be suitable for application.
2. Time delay relays shall be UL listed solid state plug-in type with adjustable time delay. Delay shall be adjustable  $\pm 200$  percent (minimum) from setpoint shown on plans. Contact rating, configuration, and coil voltage shall be suitable for application. Provide NEMA 1 enclosure when not installed in local control panel.

H. Local Control Panels

1. All indoor control cabinets shall be fully enclosed NEMA 1 construction with (hinged door) key lock latch and removable sub panels. A single key shall be common to all field panels and sub panels.
2. Interconnections between internal and face mounted devices shall be pre-wired with color coded stranded conductors neatly installed in plastic troughs and/or tie wrapped. Terminals for field connections shall be UL listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.
3. Provide on/off power switch with over current protection for control power sources to each local panel.

PART 3 - EXECUTION

### 3.1 CONTRACTOR RESPONSIBILITIES

#### A. GENERAL

Installation of the building automation system shall be performed by the Contractor or a subcontractor. However, all installation shall be under the personal supervision of the Contractor. The Contractor shall certify all work as proper and complete. Under no circumstances shall the design, scheduling, coordination, programming, training, and warranty requirements for the project be delegated to a subcontractor.

#### B. DEMOLITION

Remove controls which do not remain as part of the building automation system, all associated abandoned wiring and conduit, and all associated pneumatic tubing. The Owner will inform the Contractor of any equipment which is to be removed that will remain the property of the Owner. All other equipment which is removed will be disposed of by the Contractor.

#### C. CODE COMPLIANCE

All wiring shall be installed in accordance with all applicable electrical codes and will comply with equipment manufacturer's recommendations.

#### D. CLEANUP

At the completion of the work, all equipment pertinent to this contract shall be checked and thoroughly cleaned, and all other areas shall be cleaned around equipment provided under this contract.

#### E. WIRING, CONDUIT, AND CABLE

1. Wiring, conduit and cable shall be meet the requirements of Specification Section 260519- Low Voltage Electrical Power Conductors and Cables and this section, whichever is more demanding. All wire will be copper and meet the minimum wire size and insulation class listed below:

Wire Class	Wire Size	Isolation Class
Power	12 Gauge	600 Volt
Class One	14 Gauge Std.	600 Volt
Class Two	18 Gauge Std.	300 Volt
Class Three	18 Gauge Std.	300 volt
Communications	Per Mfr.	Per Mfr.

2. Power and Class One wiring may be run in the same conduit. Class Two and Three wiring and communications wiring may be run in the same conduit.
3. Where different wiring classes terminate within the same enclosure, maintain clearances and install barriers per the National Electric Code.
4. Where wiring is required to be installed in conduit, EMT shall be used. Conduit shall be minimum 3/4 inch galvanized EMT. Set screw fittings are acceptable for dry interior locations. Watertight compression fittings shall be used for exterior locations and interior locations subject to moisture. Provide conduit sealoff fitting where exterior conduits enter the building or between areas of high temperature/moisture differential.

5. Flexible metallic conduit (max. 3 feet) shall be used for connections to motors, actuators, controllers, and sensors mounted on vibration producing equipment. Liquid-tight flexible conduit shall be use in exterior locations and interior locations subject to moisture.
6. Junction boxes shall be provided at all cable splices, equipment termination, and transitions from EMT to flexible conduit. Interior dry location J-boxes shall be galvanized pressed steel, nominal four-inch square with blank cover. Exterior and damp location JH-boxes shall be cast alloy FS boxes with threaded hubs and gasketed covers.
7. Where the space above the ceiling is a supply or return air plenum, the wiring shall be plenum rated. Teflon wiring can be run without conduit above suspended ceilings. EXCEPTION: Any wire run in suspended ceilings that is used to control outside air dampers or to connect the system to the fire management system shall be in conduit.
8. Wiring within hollow-core walls and within equipment enclosures shall be plenum rated, neatly installed, and independently supported. At no time shall cables be affixed to other equipment, piping or wiring with wire zip ties.
9. Coaxial cable shall conform to RG62 or RG59 rating. Provide plenum rated coaxial cable when running in return air plenums.
10. Fiber optic cable shall include the following sizes; 50/125, 62.5/125 or 100/140.
11. Only glass fiber is acceptable, no plastic.
12. Fiber optic cable shall only be installed and terminated by an experienced contractor. The BAS contractor shall submit to the Engineer the name of the intended contractor of the fiber optic cable with his submittal documents.

#### F. HARDWARE INSTALLATION

##### 1. INSTALLATION PRACTICES FOR WIRING

- a. Dedicated junction boxes are shown for controls power. Contractor shall provide all required power for controls devices in their scope of work.
- b. All controllers are to be mounted vertically and per the manufacturer's installation documentation.
- c. The 120VAC power wiring to each Ethernet or Remote Site controller shall be a dedicated run, with a separate breaker. Each run will include a separate hot, neutral and ground wire. The ground wire will terminate at the breaker panel ground. This circuit will not feed any other circuit or device.
- d. Wires are to be attached to the building proper at regular intervals such that wiring does not droop. Wires are not to be affixed to or supported by pipes, conduit, etc.
- e. Conduit in finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces and wall construction. Exception; metallic surface raceway may be used in finished areas on masonry walls where permitted by the Architect. All surface raceway in finished areas must be color matched to the existing finish within the limitations of standard manufactured colors.

- f. Conduit in non-finished areas will be concealed in ceiling cavity spaces, plenums, furred spaces, and wall construction where possible. Exposed conduit will run parallel to or at right angles to the building structure.
  - g. Wires are to be kept a minimum of three (3) inches from hot water, steam, or condensate piping.
  - h. Where sensor wires leave the conduit system, they are to be protected by a plastic insert.
  - i. Wire will not be allowed to run across telephone equipment areas.
2. INSTALLATION PRACTICES FOR FIELD DEVICES
- a. Well-mounted sensors will include thermal conducting compound within the well to insure good heat transfer to the sensor.
  - b. Actuators will be firmly mounted to give positive movement and linkage will be adjusted to give smooth continuous movement throughout 100 percent of the stroke.
  - c. Relay outputs will include transient suppression across all coils. Suppression devices shall limit transients to 150% of the rated coil voltage.
  - d. Water line mounted sensors shall be removable without shutting down the system in which they are installed.
  - e. For duct static pressure sensors, the high pressure port shall be connected to a metal static pressure probe inserted into the duct pointing upstream. The low pressure port shall be left open to the plenum area at the point that the high pressure port is tapped into the ductwork.
  - f. For building static pressure sensors, the high pressure port shall be inserted into the space via a metal tube. Pipe the low pressure port to the outside of the building.
3. ENCLOSURES
- a. For all I/O requiring field interface devices, these devices where practical will be mounted in a field interface panel (FIP). The Contractor shall provide an enclosure which protects the device(s) from dust, moisture, conceals integral wiring and moving parts.
  - b. FIPs shall contain power supplies for sensors, interface relays and contactors, safety circuits, and I/P transducers.
  - c. The FIP enclosure shall be of steel construction with baked enamel finish, NEMA 1 rated with a hinged door and keyed lock. The enclosure will be sized for twenty percent spare mounting space. All locks will be keyed identically.
  - d. All wiring to and from the FIP will be to screw type terminals. Analog or communications wiring may use the FIP as a raceway without terminating. The use of wire nuts within the FIP is prohibited.
  - e. All outside mounted enclosures shall meet the NEMA-4 rating.

- f. The wiring within all enclosures shall be run in plastic track. Wiring within controllers shall be wrapped and secured.
4. IDENTIFICATION
- a. Identify all control wires with labeling tape or sleeves using either words, letters, or numbers that can be exactly cross-referenced with as-built drawings.
  - b. All field enclosures, other than controllers, shall be identified with a bakelite nameplate. The lettering shall be in white against a black or blue background.
  - c. Junction box covers will be marked to indicate that they are a part of the BAS system.
  - d. All I/O field devices (except space sensors) that are not mounted within FIP's shall be identified with name plates.
  - e. All I/O field devices inside FIP's shall be labeled.
- G. EXISTING CONTROLS
- Existing controls which are to be reused must each be tested and calibrated for proper operation. Existing controls which are to be reused and are found to be defective requiring replacement, will be reported in writing to the Owner. The Owner will be responsible for all material and labor costs associated with their repair.
- H. CONTROL SYSTEM SWITCH-OVER
- 1. Demolition of the existing control system will occur after the new temperature control system is in place including new sensors and new field interface devices.
  - 2. Switch-over from the existing control system to the new system will be fully coordinated with the Owner. A representative of the Owner will be on site during switch-over, at the Owner's discretion.
  - 3. The Contractor shall minimize control system downtime during switch-over. Sufficient installation mechanics will be on site so that the entire switch-over can be accomplished in a reasonable time frame.
  - 4. All interruptions to the building controls shall be scheduled in advance, with at least 7 days' notice. Owner shall have the right to reschedule to suit occupancy needs.
- I. LOCATION
- 1. The location of sensors is per mechanical and architectural drawings.
  - 2. Space humidity or temperature sensors will be mounted away from machinery generating heat, direct light and diffuser air streams.
  - 3. Outdoor air sensors will be mounted on the north building face directly in the outside air. Install these sensors such that the effects of heat radiated from the building or sunlight is minimized.
  - 4. Field enclosures shall be located immediately adjacent to the controller panel(s) to which it is being interfaced.

J. SOFTWARE INSTALLATION

1. GENERAL.

The Contractor shall provide all labor necessary to install, initialize, start-up and debug all system software as described in this section. This includes any operating system software or other third party software necessary for successful operation of the system.

2. DATABASE CONFIGURATION.

The Contractor will provide all labor to configure those portions of the database that are required by the points list and sequence of operation.

3. COLOR GRAPHIC SLIDES.

The Contractor will provide color graphic displays for each system and floor plan. For each system or floor plan, the display shall contain the associated points identified in the point list and allow for setpoint changes as required by the owner.

4. REPORTS.

The Contractor will configure the following reports for the owner:

- a. Unit Ventilator Status Report
- b. Fan Coil Unit Status Report
- c. Space Temperature Report
- d. Floor Zone Damper Status Report

5. DOCUMENTATION

As built software documentation will include the following:

- a. Descriptive point lists
- b. Application program listing
- c. Application programs with comments.
- d. Printouts of all reports.
- e. Alarm list.
- f. Printouts of all graphics
- g. Commissioning and System Startup

6. POINT TO POINT CHECKOUT.

Each I/O device (both field mounted as well as those located in FIPs) shall be inspected and verified for proper installation and functionality. A checkout sheet itemizing each device shall be filled out, dated and approved by the Project Manager for submission to the owner or owner's representative.

7. CONTROLLER AND WORKSTATION CHECKOUT.

A field checkout of all controllers and front end equipment (computers, printers, modems, etc.) shall be conducted to verify proper operation of both hardware and software. A checkout sheet itemizing each device and a description of the associated tests shall be



prepared and submitted to the owner or owner's representative by the completion of the project.

8. SYSTEM ACCEPTANCE TESTING

- a. All application software will be verified and compared against the sequences of operation. Control loops will be exercised by inducing a setpoint shift of at least 10% and observing whether the system successfully returns the process variable to setpoint. Record all test results and attach to the Test Results Sheet.
- b. Test each alarm in the system and validate that the system generates the appropriate alarm message, that the message appears at all prescribed destinations (workstations or printers), and that any other related actions occur as defined (i.e. graphic panels are invoked, reports are generated, etc.). Submit a Test Results Sheet to the owner.
- c. Perform an operational test of each unique graphic display and report to verify that the item exists, that the appearance and content are correct, and that any special features work as intended. Submit a Test Results Sheet to the owner.
- d. Perform an operational test of each third party interface that has been included as part of the automation system. Verify that all points are properly polled, that alarms have been configured, and that any associated graphics and reports have been completed. If the interface involves a file transfer over Ethernet, test any logic that controls the transmission of the file, and verify the content of the specified information.

END OF SECTION

SECTION 23 09 93  
SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control sequences for HVAC systems, subsystems, and equipment. All sequences and equipment listed in this section shall be controlled through local dedicated control components.
- B. See individual specifications for particular equipment which may call for additional controls capability and devices.
- C. Coordinate setback periods and temperatures with Owner. All systems shall be capable of setback functionality.
- D. Provide occupant override switch on all thermostats. Program override switch for two hours duration (adjustable).
- E. Provide all devices necessary to accomplish the Sequence of Operations indicated, whether specifically indicated or not.
- F. Replace controllers in existing fan coil units and unit ventilators in the area of work. Implement Sequence of Operations in all units, existing and new, in the area of work.

1.2 FAN COIL UNITS (FCU)

General

Individual fan coil setpoints and fan speed shall be adjustable at each unit.

Occupied

Controller shall utilize adaptive start algorithms to reach setpoint temperature at time of occupancy. Outside air damper shall be open. Controller shall modulate heating/cooling control valve to maintain a winter space temperature of 70°F (adjustable) and a summer space temperature of 75°F (adjustable). Fan shall run continuously. System shall determine heating and cooling mode via temperature sensor on Dual Temperature Water Supply piping. Controls shall automatically sequence valve and fan to maintain space conditions at minimum fan speed.

Unoccupied

Outside air damper shall be closed. Controller shall modulate heating/cooling control valve to maintain a winter space setback temperature of 55°F (adjustable) and a summer space temperature of 85°F (adjustable). Fan shall run only when necessary to maintain setback temperatures. System shall determine heating and cooling mode via temperature sensor on Dual Temperature Water Supply piping.

Upon loss of power, valves shall Fail Open to flow through coil and outside air damper shall fail closed. Upon sensing high water in drain pan, FCU shall shut off and alarm shall be generated.

1.3 UNIT VENTILATORS (UV)

General

Individual UV setpoints and fan speed shall be adjustable at each unit.

Occupied

Controller shall utilize adaptive start algorithms to reach setpoint temperature at time of occupancy. Outside air damper shall be open. Controller shall modulate face and bypass dampers to maintain a winter space temperature of 70°F (adjustable) and a summer space temperature of 75°F (adjustable). Fan shall run continuously. System shall determine heating and cooling mode via temperature sensor on Dual Temperature Water Supply piping. Controls shall automatically sequence dampers to maintain space conditions. When outside conditions permit, UV outside air damper shall go to full open to provide free cooling.

Unoccupied

Outside air damper shall be closed. Controller shall cycle fan to maintain a winter space setback temperature of 55°F (adjustable) and a summer space temperature of 85°F (adjustable). Fan shall run only when necessary to maintain setback temperatures. System shall determine heating and cooling mode via temperature sensor on Dual Temperature Water Supply piping. Controls shall automatically operate fan to maintain space conditions at minimum fan speed.

Upon loss of power, outside air damper shall fail closed. Upon sensing high water in drain pan, UV shall shut off and alarm shall be generated.

1.4 FLOOR DUAL DUCT CONTROL DAMPERS

Occupied

Hot and cold duct dampers shall modulate in tandem to maintain a winter space temperature of 70°F (adjustable) and a summer space temperature of 75°F (adjustable). Dampers shall maintain constant volume flow in the mixed air duct.

Unoccupied

Hot and cold duct dampers shall modulate in tandem to maintain a winter setback temperature of 55°F (adjustable) and a summer space temperature of 85°F (adjustable).

1.5 TRANSFER FAN ON LOCAL TEMPERATURE CONTROL

Fan shall be activated by local space temperature sensor. Initial setpoint 85 degrees F.

PART 2- PRODUCTS (Not Applicable)

PART 3- EXECUTION (Not Applicable)

END OF SECTION

SECTION 23 21 13  
HYDRONIC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes pipe and fitting materials, joining methods, special-duty valves, and specialties for the following:
  - 1. Dual temperature-water piping.
  - 2. Condensate-drain piping.

1.3 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature:
  - 1. Dual temperature-water piping, underground and above ground: 40 psig at 200 deg F.
  - 2. Condensate-Drain Piping: 40-150 deg F.

1.4 SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Plastic pipe and fittings with solvent cement.
  - 2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
  - 3. Air control devices.
  - 4. Hydronic specialties.
- B. Shop Drawings: Detail, 3/8"=1'-0" scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion loops.
- C. Welding certificates.

**New Jersey City University: Nursing Education Center  
Renovations to Rossey Hall**

2039 John F. Kennedy Boulevard  
Jersey City, NJ 07305

**Clarke Caton Hintz  
Construction Documents**

December 4, 2017

- D. Qualification Data: For Installer.
- E. Field quality-control test reports.
- F. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anvil International, Inc.
    - b. S. P. Fittings; a division of Star Pipe Products.
- E. Wrought-Copper Unions: ASME B16.22.
- F. Alternate connecting methods, such as field extruded tees, fittings using gasketed joints, etc. will not be accepted.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.

**HYDRONIC PIPING**

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- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  - 1. Material Group: 1.1.
  - 2. End Connections: Butt welding.
  - 3. Facings: Raised face.
- H. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

## 2.3 PLASTIC PIPE AND FITTINGS

- A. PVC Plastic Pipe: ASTM D 1785, Schedules 40, plain ends as indicated in Part 3 "Piping Applications" Article.
- B. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466.

## 2.4 JOINING MATERIALS

- A. 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 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.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, 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 joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
    - a. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - b. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    - c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- H. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## 2.5 TRANSITION FITTINGS

- A. Plastic-to-Metal Transition Fittings:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Charlotte Pipe and Foundry Company.
    - b. IPEX Inc.
    - c. KBi.
  - 2. PVC one-piece fitting with one threaded brass or copper insert and one Schedule 80 solvent-cement-joint end.
- B. Plastic-to-Metal Transition Unions:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Charlotte Pipe and Foundry Company.
    - b. IPEX Inc.

- c. KBi.
  - d. NIBCO INC.
2. MSS SP-107, PVC union. Include brass or copper end, Schedule 80 solvent-cement-joint end, rubber gasket, and threaded union.

## 2.6 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
- B. Dielectric Unions:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Hart Industries International, Inc.
    - d. Jomar International Ltd.
    - e. Matco-Norca, Inc.
    - f. McDonald, A. Y. Mfg. Co.
    - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - h. Wilkins; a Zurn company.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Pressure Rating: 125 psig minimum at 180 deg F.
    - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Capitol Manufacturing Company.
    - b. Central Plastics Company.
    - c. Matco-Norca, Inc.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    - e. Wilkins; a Zurn company.
  - 2. Description:
    - a. Standard: ASSE 1079.
    - b. Factory-fabricated, bolted, companion-flange assembly.
    - c. Pressure Rating: 125 psig minimum at 180 deg F.



- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Advance Products & Systems, Inc.
  - b. Calpico, Inc.
  - c. Central Plastics Company.
  - d. Pipeline Seal and Insulator, Inc.
- 2. Description:
  - a. Nonconducting materials for field assembly of companion flanges.
  - b. Pressure Rating: 150 psig.
  - c. Gasket: Neoprene or phenolic.
  - d. Bolt Sleeves: Phenolic or polyethylene.
  - e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Elster Perfection.
  - b. Grinnell Mechanical Products.
  - c. Matco-Norca, Inc.
  - d. Precision Plumbing Products, Inc.
  - e. Victaulic Company.
- 2. Description:
  - a. Standard: IAPMO PS 66
  - b. Electroplated steel nipple. complying with ASTM F 1545.
  - c. Pressure Rating: 300 psig at 225 deg F.
  - d. End Connections: Male threaded or grooved.
  - e. Lining: Inert and noncorrosive, propylene.

2.7 VALVES

- A. Gate, Globe, Check and Ball Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."

C. Diaphragm-Operated, Pressure-Reducing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Low inlet-pressure check valve.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

D. Diaphragm-Operated Safety Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Amtrol, Inc.
  - b. Armstrong Pumps, Inc.
  - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
  - d. Conbraco Industries, Inc.
  - e. Spence Engineering Company, Inc.
  - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Body: Bronze or brass.
3. Disc: Glass and carbon-filled PTFE.
4. Seat: Brass.
5. Stem Seals: EPDM O-rings.
6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

E. Automatic Flow-Control Valves:

1. Externally adjustable, pressure independent flow limiting device with external lockable handle and integrated pressure/temperature ports.
2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. ITT Bell & Gossett
  - b. Flow Design Inc.
  - c. Griswold Controls.
  - d. Hayes
3. Body: Brass or ferrous metal.
4. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
5. Combination Assemblies: Include bronze or brass-alloy ball valve.
6. Identification Tag: Marked with zone identification, valve number, and flow rate.
7. Size: Same as pipe in which installed.
8. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
9. Minimum CWP Rating: 175 psig.
10. Maximum Operating Temperature: 250 deg F.

## 2.8 AIR CONTROL DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  1. Amtrol, Inc.
  2. Armstrong Pumps, Inc.
  3. Bell & Gossett Domestic Pump; a division of ITT Industries.
  4. Taco.
- B. Manual Air Vents:
  1. Body: Bronze.
  2. Internal Parts: Nonferrous.
  3. Operator: Screwdriver or thumbscrew.
  4. Inlet Connection: NPS 1/2.
  5. Discharge Connection: NPS 1/8.
  6. CWP Rating: 150 psig.
  7. Maximum Operating Temperature: 225 deg F.
- C. Automatic Air Vents:
  1. Body: Bronze or cast iron.
  2. Internal Parts: Nonferrous.
  3. Operator: Noncorrosive metal float.
  4. Inlet Connection: NPS 1/2.
  5. Discharge Connection: NPS 1/4.
  6. CWP Rating: 150 psig.

7. Maximum Operating Temperature: 240 deg F.

## 2.9 HYDRONIC PIPING SPECIALTIES

### A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 60-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

### B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

## PART 3 - EXECUTION

### 3.1 PIPING APPLICATIONS

#### A. Dual temperature-water piping NPS 2 and smaller, shall be either of the following:

1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.

#### B. Dual temperature-water piping NPS 2-1/2 and larger, shall be the following:

1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.

#### C. Condensate-Drain Piping- cold condensate: Type M, drawn-temper copper tubing, wrought-copper fittings, and soldered joints or Schedule 40 PVC plastic pipe and fittings and solvent-welded joints. Copper tubing only in air plenums.

#### D. Air-Vent Piping:

1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

- E. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

### 3.2 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains, and at supply connection to each piece of equipment.
- B. Install throttling-duty valves at each branch connection to return main.
- C. Install autoflow balancing valves for each heating or cooling terminal.

### 3.3 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicate piping locations and arrangements if such were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- B. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

- L. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at all low points in piping system and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Division 23 Section "General-Duty Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 and larger, at final connections of equipment and elsewhere as indicated.
- S. Install strainers on inlet side of each control valve, solenoid valve and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- T. Install expansion loops, anchors, and pipe alignment guides as required to permit flexibility for pipe expansion. Expansion joints or fittings shall not be permitted.
- U. Identify piping as specified in Division 23 Section "Identification for HVAC Piping and Equipment."
- V. Install sleeves for piping penetrations of walls, ceilings, and floors.

#### 3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

- C. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
  - 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
  - 6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
  - 7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
  
- D. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
  - 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
  - 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  - 4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
  
- E. Plastic Piping Hanger Spacing: Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading. Space and install hangers with the fewest practical rigid anchor points.
  
- F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
  
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
  
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
  
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
  
- E. 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.

- F. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- G. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- H. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. PVC Nonpressure Piping: Join according to ASTM D 2855.

### 3.6 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at all high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. Extend vent to an accessible location with accessible bleed valve where access is not available, such as a terminal unit within a security enclosure.
- B. Install automatic air vents at high points of system piping in mechanical equipment rooms only. Manual vents at heat-transfer coils and elsewhere as required for air venting.
- C. Install drain valves at all hydronic piping low points.

### 3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.
- B. Install control valves in accessible locations close to connected equipment. See drawings for locations. Adjust location as necessary for coordination with required access.
- C. Install ports for pressure gages and thermometers at coil inlet and outlet connections according to Division 23 Section "Meters and Gages for HVAC Piping."

### 3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.



4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  3. Isolate expansion tanks and determine that hydronic system is full of water.
  4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
  5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Set makeup pressure-reducing valves for required system pressure.
  3. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  4. Set temperature controls so all coils are calling for full flow.
  5. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  6. Verify lubrication of motors and bearings.

END OF SECTION

SECTION 23 31 13  
METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Division 23 Section "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Division 23 Section "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
  2. Factory- and shop-fabricated ducts and fittings.
  3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
  4. Elevation of top of ducts.
  5. Dimensions of main duct runs from building grid lines.
  6. Fittings.
  7. Reinforcement and spacing.
  8. Seam and joint construction.
  9. Penetrations through fire-rated and other partitions.
  10. Equipment installation based on equipment being used on Project.
  11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
  12. Hangers and supports, including methods for duct and building attachment and vibration isolation.
- C. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved. See Div 1 section "Project Management and Coordination" and section "Common Work Results for HVAC" for further requirements.
1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
  2. Suspended ceiling components.
  3. Structural members to which duct will be attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Penetrations of smoke barriers and fire-rated construction.
  6. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Sprinklers.
    - d. Access panels.
- D. Field quality-control reports.

#### 1.5 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

**PART 2 - PRODUCTS**

**2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

**2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS**

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 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. Lindab Inc.
    - b. McGill AirFlow LLC.
    - c. SEMCO Incorporated.
    - d. Sheet Metal Connectors, Inc.
    - e. Spiral Manufacturing Co., Inc.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support

intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
  - 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.4 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. CertainTeed Corporation; Insulation Group.
    - b. Johns Manville.
    - c. Knauf Insulation.
    - d. Owens Corning.
    - e. Maximum Thermal Conductivity:
      - 1) Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      - 2) Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
  - 2. Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Liner

- shall consist of continuous black composite facing similar to that on Certainteed "Toughguard".
3. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C 916.
    - a. 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).
    - b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick stainless steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
  2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
  3. Butt transverse joints without gaps, and coat joint with adhesive.
  4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
  5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
  6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
  7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
  8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    - a. Fan discharges.
    - b. Intervals of lined duct preceding unlined duct.
    - c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.
  9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.
    - a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  2. Tape Width: 6 inches.
  3. Sealant: Modified styrene acrylic.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Water-Based Joint and Seam Sealant:
  1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
  1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, use sealant that has a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
  1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

## 2.6 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.
- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
  1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  2. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.



- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- I. Route ducts to avoid passing through electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 23 Section "Air Duct Accessories" for fire dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

### 3.3 DUCT SEALING

- A. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
  - 1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 2. All Supply-Air and Return Air Ducts: Seal Class A.

3. Dryer vents: Seal Class A.
4. Exhaust Ducts: Seal Class B.
5. Outside Air Intake Ducts: Seal Class B.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  2. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Division 23 Section "Air Duct Accessories."
- B. Comply with details on the drawings for branch, outlet and inlet, and terminal unit connections. Where not detailed, comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible".
- C. Do not use screws or fasteners which penetrate into vents.

### 3.6 FIELD QUALITY CONTROL

- A. Duct System Cleanliness Tests:
  1. Visually inspect duct system to ensure that no visible contaminants are present.
- B. Duct system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

1. Provide written certification that these procedures have been followed.

### 3.7 ADDITIONAL INSTALLATION REQUIREMENTS FOR DISHWASHER EXHAUST DUCT

- A. Install dishwasher exhaust ducts without dips and traps that may hold water, and sloped a minimum of 2 percent to drain back to the hood.

### 3.8 START UP

- A. Air Balance: Comply with requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC."

### 3.9 DUCT SCHEDULE

- A. Fabricate all ducts with galvanized sheet steel or stainless steel as indicated.

- B. Supply Ducts:

1. All supply ductwork:
  - a. Pressure Class: Positive 2-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 12.
  - d. SMACNA Leakage Class for Round: 12.

- C. Return Ducts:

1. All return ductwork:
  - a. Pressure Class: Positive or negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: A.
  - c. SMACNA Leakage Class for Rectangular: 24.

- D. Exhaust Ducts:

1. All exhaust ductwork:
  - a. Pressure Class: Negative 2-inch wg.
  - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
  - c. SMACNA Leakage Class for Rectangular: 24.
  - d. SMACNA Leakage Class for Round: 12.

- E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

- F. Liner: Install liner only as indicated on drawings.

1. Supply Air Ducts: Fibrous glass, Type I, 1 inch thick.
2. Return Air Ducts: Fibrous glass, Type I, 1 inch thick.

- G. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Velocity 1000 fpm or Lower:
    - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
    - 2) Mitered Type RE 4 without vanes.
  - b. Velocity 1000 to 1500 fpm:
    - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
    - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
    - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - c. Velocity 1500 fpm or Higher:
    - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
  - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
  - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
  - c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
  - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
    - 1) Velocity 1000 fpm or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
    - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
    - 3) Velocity 1500 fpm or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
    - 4) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

H. Branch Configuration:

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1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
  - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  - b. Rectangular Main to Round Branch: Spin in.
  
2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
  - a. Velocity 1000 fpm or Lower: 90-degree tap.
  - b. Velocity 1000 to 1500 fpm: Conical tap.
  - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 33 00  
AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Flange connectors.
  - 3. Turning vanes.
  - 4. Remote damper operators.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
  - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
    - a. Special fittings.
    - b. Manual volume damper installations.
    - c. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.
- B. Source quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

**PART 2 - PRODUCTS**

**2.1 ASSEMBLY DESCRIPTION**

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

**2.2 MATERIALS**

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G90.
- B. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

**2.3 MANUAL VOLUME DAMPERS**

- A. Standard, Steel, Manual Volume Dampers:
  - 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. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Flexmaster U.S.A., Inc.
    - d. McGill AirFlow LLC.
    - e. Nailor Industries Inc.
    - f. Pottorff.
    - g. Ruskin Company.
    - h. Trox USA Inc.
    - i. Vent Products Company, Inc.
  - 2. Standard leakage rating.
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
    - b. Mitered and welded corners.

- c. Flanges for attaching to walls and flangeless frames for installing in ducts.
- 5. Blades:
  - a. Multiple or single blade.
  - b. Parallel- or opposed-blade design.
  - c. Stiffen damper blades for stability.
  - d. Galvanized-steel, 0.064 inch thick.
- 6. Blade Axles: Galvanized steel.
- 7. Bearings:
  - a. Oil-impregnated bronze.
  - b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
- 8. Tie Bars and Brackets: Galvanized steel.
- B. Jackshaft:
  - 1. Size: 1-inch diameter.
  - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
  - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- C. Damper Hardware:
  - 1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
  - 2. Include center hole to suit damper operating-rod size.
  - 3. Include elevated platform for insulated duct mounting.

## 2.4 FLANGE CONNECTORS

- 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. Ductmate Industries, Inc.
  - 2. Nexus PDQ; Division of Shilco Holdings Inc.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.



- E. 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. Ductmate Industries, Inc.
  - 2. Duro Dyne Inc.
  - 3. Elgen Manufacturing.
  - 4. METALAIRE, Inc.
  - 5. SEMCO Incorporated.
  - 6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  
- F. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
  
- G. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows. Retain one of two "Vane Construction" paragraphs below.
  
- H. Vane Construction: Single wall for ducts up to 48 inches wide and double wall for larger dimensions.

## 2.5 REMOTE DAMPER OPERATORS

- 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. Pottorff.
  - 2. Young Regulator Company.
  
- B. Description: Cable system designed for remote manual damper adjustment.
  
- C. Tubing: Aluminum.
  
- D. Cable: Stainless steel.
  
- E. Wall-Box Mounting: Recessed.
  
- F. Wall-Box Cover-Plate Material: Stainless steel.

## 2.6 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. American Warming and Ventilating; a division of Mestek, Inc.
  - 2. Cesco Products; a division of Mestek, Inc.
  - 3. Ductmate Industries, Inc.
  - 4. Flexmaster U.S.A., Inc.
  - 5. Greenheck Fan Corporation.

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6. McGill AirFlow LLC.
7. Nailor Industries Inc.
8. Pottorff.
9. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; "Duct Access Doors and Panels," "Access Doors - Round Duct."

1. Door:
  - a. Double wall, rectangular.
  - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
  - c. Hinges and Latches: 1-by-1-inch butt or piano hinge and cam latches.
  - d. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
  - a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
  - b. Access Doors up to 18 Inches Square: Continuous and two sash locks.
  - c. Access Doors up to 24 by 48 Inches: Continuous and two compression latches.

**2.7 FLEXIBLE CONNECTORS**

- 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. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Elgen Manufacturing.
  4. Ventfabrics, Inc.
  5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
1. Minimum Weight: 26 oz./sq. yd..
  2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F.

## 2.8 FLEXIBLE DUCTS

- 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. Flexmaster U.S.A., Inc.
  - 2. McGill AirFlow LLC.
  - 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
  
- B. Insulated, Flexible Duct: UL 181, Class 0, interlocking spiral of aluminum foil; fibrous-glass insulation; aluminized vapor-barrier film.
  - 1. Pressure Rating: 8-inch wg positive or negative.
  - 2. Maximum Air Velocity: 5000 fpm.
  - 3. Temperature Range: Minus 20 to plus 250 deg F.
  - 4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.
  
- C. Flexible Duct Connectors:
  - 1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
  - 2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts.
  
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
  
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  - 1. Install steel volume dampers in steel ducts.
  
- D. Set dampers to fully open position before testing, adjusting, and balancing.
  
- E. Install fire dampers according to UL listing.
  
- F. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
3. At each change in direction and at maximum 50-foot spacing.
4. Elsewhere as indicated.

G. Install access doors with swing against duct static pressure.

H. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.

I. Label access doors according to Division 23 Section "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

J. Install flexible connectors to connect ducts to equipment.

K. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws. Flexible duct shall be hung in such a manner as to not kink the air flow passage. Maximum allowable length of flexible ductwork shall be 6 feet. Flexible ductwork shall be installed only above accessible ceilings.

### 3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION

SECTION 23 34 23  
POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Ceiling-mounting ventilators.
  - 2. In-line centrifugal fans.

1.3 PERFORMANCE REQUIREMENTS

- A. Project Altitude: Base fan-performance ratings on sea level.
- B. Operating Limits: Classify according to AMCA 99.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
  - 1. Certified fan performance curves with system operating conditions indicated.
  - 2. Certified fan sound-power ratings.
  - 3. Motor ratings and electrical characteristics, plus motor and electrical accessories.
  - 4. Material thickness and finishes, including color charts.
  - 5. Dampers, including housings, linkages, and operators.
  - 6. Fan speed controllers.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Size and location of initial access modules for acoustical tile.
  - 3. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.

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- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. AMCA Compliance: Products shall comply with performance requirements and shall be licensed to use the AMCA-Certified Ratings Seal.
- C. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- D. UL Standard: Power ventilators shall comply with UL 705.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fans as factory-assembled unit with protective crating and covering.
- B. Lift and support units with manufacturer's designated lifting or supporting points.

1.7 COORDINATION

- A. Coordinate size and location of structural-steel support members.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

PART 2 - PRODUCTS

2.1 CEILING-MOUNTING VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Broan Mfg. Co., Inc.
  - 2. Carnes Company HVAC.
  - 3. Greenheck.
  - 4. Loren Cook Company.
  - 5. NuTone Inc.
  - 6. Penn Ventilation.
- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.

- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories (as called for in schedules):
  - 1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
  - 2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
  - 3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
  - 4. Motion Sensor: Motion detector with adjustable shutoff timer.
  - 5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
  - 6. Filter: Washable aluminum to fit between fan and grille.
  - 7. Isolation: Rubber-in-shear vibration isolators.
  - 8. Manufacturer's standard roof jack or wall cap, and transition fittings.
- H. Capacities and Characteristics shall be as indicated in the schedules:

## 2.2 IN-LINE CENTRIFUGAL FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Acme Engineering & Mfg. Corp.
  - 2. Carnes Company HVAC.
  - 3. Greenheck.
  - 4. Loren Cook Company.
  - 5. Penn Ventilation.
- B. Description: In-line, direct or belt-driven centrifugal fans consisting of housing, wheel, outlet guide vanes, fan shaft, bearings, motor and disconnect switch, drive assembly, mounting brackets, and accessories.
- C. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.
- D. Direct-Driven Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing with wheel, inlet cone, and motor on swing-out service door.
- E. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.
- F. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.
- G. Accessories (as indicated in schedules):

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

H. Capacities and Characteristics shall be as shown on drawings:

## 2.5 MOTORS

- A. Comply with requirements in Division 23 Section "COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT."
- B. Enclosure Type: Totally enclosed, fan cooled.

## 2.6 SOURCE QUALITY CONTROL

- A. Sound-Power Level Ratings: Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.
- B. Fan Performance Ratings: Establish flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests and ratings according to AMCA 210, "Laboratory Methods of Testing Fans for Rating."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units as indicated in Division 23 Section "Mechanical Vibration Controls."
- C. Ceiling Units: Suspend units from structure; use treaded rod and locking nuts.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 23 Section "Mechanical Identification."

### 3.2 CONNECTIONS

- A. Duct installation and connection requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 23 Section "Duct Accessories."



- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Division 26 Section "Grounding and Bonding."
- D. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
  - 1. Verify that shipping, blocking, and bracing are removed.
  - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  - 3. Verify that cleaning and adjusting are complete.
  - 4. Verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation.
  - 5. Adjust damper linkages for proper damper operation.
  - 6. Verify lubrication for bearings and other moving parts.
  - 7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  - 8. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  - 9. Shut unit down and reconnect automatic temperature-control operators.
  - 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

### 3.4 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Adjust belt tension.
- C. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

END OF SECTION

SECTION 23 37 13  
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes ceiling-, sill and wall-mounted diffusers, registers, and grilles.
- B. Related Sections include the following:
  - 1. Division 23 Section "Duct Accessories" for fire dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 SUBMITTALS

- A. Product Data: For each product indicated, include the following:
  - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - 2. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension assembly members.
  - 2. Method of attaching hangers to building structure.
  - 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
  - 4. Duct access panels.
- C. Color Samples: For diffusers, registers, and grilles, to allow color selection.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 1. Subject to compliance with requirements, provide products by one of the manufacturers specified.

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2.2 GRILLES AND REGISTERS

A. Grilles and Registers

1. Manufacturers:
  - a. Titus.
  - b. Anemostat; a Mestek Company.
  - c. Carnes.
  - d. Krueger.
  - e. Nailor Industries of Texas Inc.
  - f. Price Industries.
  - g. Tuttle & Bailey.
2. Material: Steel or aluminum.
3. Finish: See below.
4. Face Arrangement: as indicated
5. Mounting: to match ceiling, floor or wall type. Provide all necessary mounting accessories.
6. Damper Type: Adjustable opposed-blade assembly.
7. All wall supply registers to be double deflection type with individually adjustable blades.

2.3 CEILING DIFFUSER OUTLETS

A. Rectangular and Square Ceiling Diffusers

1. Manufacturers:
  - a. Titus
  - b. Anemostat; a Mestek Company.
  - c. Carnes.
  - d. Krueger.
  - e. Nailor Industries of Texas Inc.
  - f. Price Industries.
  - g. Tuttle & Bailey.
2. Material: Steel or aluminum
3. Finish: See below.
4. Face Size: as indicated
5. Face Style: as indicated
6. Mounting: Mounting: to match ceiling type
7. Dampers: Butterfly or Combination damper and grid
8. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring as required.
  - c. Ceiling radiation damper as required.
  - d. All other accessories needed to mount diffuser in specified surface.

2.4 FINISH FOR REGISTERS AND GRILLES

A. Colors and finishes as selected by Architect.

1. In public area wall assemblies: Shop prime for paint finish. Paint exposed surfaces and fasteners with semi-gloss paint, color as selected by Architect. Refer to Division 09 Section "Painting".

2. In back of house wall assemblies: Baked enamel, white.
3. In public area ceiling assemblies: Shop prime for paint finish. Paint exposed surfaces and fasteners with semi-gloss paint, color as selected by Architect. Refer to Division 09 Section "Painting".
4. In back of house ceiling assemblies: Baked enamel, white.
5. In floor assemblies: Color as selected by Architect from manufacturer's full range, including stainless steel and brass finishes.

## 2.5 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb. Locate where indicated on architectural drawings.
- B. Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated where indicated on architectural drawings where possible, as much as practicable. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Provide all accessories needed to mount diffusers, registers and grilles in surfaces indicated.
- E. Install aluminum grilles in residential bathrooms and other areas subject to moisture.

### 3.3 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 23 82 19  
FAN-COIL UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes fan-coil units and accessories.

1.3 DEFINITIONS

- A. BAS: Building automation system.

1.4 SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Ceiling suspension components.
  - 2. Structural members to which fan-coil units will be attached.
  - 3. Method of attaching hangers to building structure.
  - 4. Size and location of initial access modules for acoustical tile.
  - 5. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
- D. Field quality-control test reports.

- E. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
  - 1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.
- F. Warranty: Special warranty specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### 1.6 COORDINATION

- A. Coordinate layout and installation of fan-coil units with other construction including light fixtures, HVAC equipment, fire-suppression-system components, electrical components and partition assemblies. Coordinate replacement fan coil units with existing piping and outside air wall opening.

#### 1.7 WARRANTY

- A. Manufacturer's standard form in which manufacturer agrees to repair or replace components that fail in materials or workmanship within specified warranty period.

#### 1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan-Coil-Unit Filters: Furnish two spare filters for each filter installed.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In the Fan-Coil-Unit Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

#### 2.2 FAN-COIL UNITS

- A. Manufacturers:

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1. Carrier Corporation.
  2. International Environmental Corporation.
  3. Trane.
  4. JCI.
- B. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.
- C. Coil Section Insulation: 1-inch thick, coated glass fiber complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.
1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.
- D. Main and Auxiliary Drain Pans: Plastic or insulated galvanized steel with plastic liner formed to slope from all directions to the drain connection as required by ASHRAE 62. Drain pans shall be removable where required for access to valves and accessories.
- E. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.
- F. Cabinet: Steel with baked-enamel finish.
1. Vertical Unit Front Panels: Removable, steel, with cam fasteners, and insulation on back of panel.
  2. Extended cabinet for installation of control valve assembly and accessories.
  3. Finish for fan coil units: Colors and finishes as selected by Architect.  
In public area wall assemblies: Shop prime for paint finish. Paint exposed surfaces and fasteners with semi-gloss paint, custom color as selected by Architect. Refer to Division 09 Section "Painting".
- G. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.
- H. Fan and Motor Board: Removable.
1. Fan: Forward curved, double width, centrifugal; directly connected to motor. Thermoplastic or painted-steel wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
  2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Motors."
  3. Wiring Termination: Connect motor to chassis wiring with plug connection.
- I. Hydronic Piping: ASTM B 88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet. Provide all devices as shown on drawings.
1. Three-way, modulating control valve for dual temperature-water coil.
  2. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.

3. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig.
  4. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.
  5. Wrought-Copper Unions: ASME B16.22.
- J. Fan Coil Unit Controller: Controller shall be by Andover Controls to integrate with balance of building systems. See specification "Instrumentation and Controls" for controls requirements.
- K. Electrical Connection: Factory wire motors and controls for a single electrical connection.
- L. Capacities and Characteristics: See drawings

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine existing conditions for piping and electrical connections to verify actual locations before fan-coil-unit installation.
- C. Clean outside air intakes and provide transitions needed to accommodate air path into fan coil. Seal between intake and fan coil cabinet so that there is no air leakage into the room.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Install fan-coil units level and plumb.
- B. Install fan-coil units to comply with NFPA 90A.
- C. Verify locations of thermostats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above finished floor.
- D. Do not operate fan coil units during construction without filters. Install new filters in each fan-coil unit within two weeks after Substantial Completion. If dust or debris has been found to enter any system, contractor shall internally vacuum and clean all internal duct surfaces. Provide all openings in ductwork and architectural surfaces necessary to accomplish cleaning as well as necessary repairs.



### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:
  - 1. Install piping adjacent to machine to allow service and maintenance.
  - 2. Coordinate with other trades to allow ready access to all valves.
  - 3. Install piping so as to allow ready access to fire dampers.
  - 4. Connect condensate drain as indicated.
    - a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

### 3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
  - 3. Demonstrate access to all valves and actuators to the satisfaction of Owner's personnel. Tag heating solenoid valve and demonstrate access for manual operation.
- B. Remove and replace malfunctioning units and retest as specified above.

### 3.5 ADJUSTING

- A. Adjust initial temperature set points.
- B. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project for this purpose.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fan-coil units. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION

SECTION 26 05 00  
COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: The Work of this Section includes, but is not limited to, the following:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.02 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.03 SUBMITTALS

- A. Product Data: For sleeve seals.

1.04 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  3. To allow right of way for piping and conduit installed at required slope.
  4. So connecting raceways, cables and wireways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.
- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

- A. Sleeves for Rectangular Openings: Galvanized sheet steel.
1. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches , thickness shall be 0.052 inch .
- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches , thickness shall be 0.138 inch .

## 2.02 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  3. Pressure Plates: Plastic. Include two for each sealing element.
  4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways or cables penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.04 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION

SECTION 26 05 19  
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-dieneterpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.05 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Insulated Wire Corp.; a Leviton Company.
  - 2. General Cable Corporation.
  - 3. Senator Wire & Cable Company.
  - 4. Southwire Company.
- B. Copper Conductors: Comply with NEMA WC 70.

- C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, USE and SO.
- D. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable (steel jacket), Type MC, Type SO and Type USE with ground wire.

## 2.02 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## PART 3 - EXECUTION

### 3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

### 3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- C. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Metal-clad cable, Type MC.
- E. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- F. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, and strain relief device at terminations to suit application.
- G. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- H. Class 2 Control Circuits: Power-limited cable, concealed in building finishes.

**3.03 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

**3.04 CONNECTIONS**

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

**3.05 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

**3.06 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

**3.07 FIELD QUALITY CONTROL**

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and

conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.

- a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
  - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports: Prepare a written report to record the following:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION



SECTION 26 05 26  
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
  1. Burndy; Part of Hubbell Electrical Systems.
  2. ERICO International Corporation.
  3. O-Z/Gedney; A Brand of the EGS Electrical Group.
  4. Robbins Lightning, Inc.

2.02 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## 2.03 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 6. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.04 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

## PART 3 - EXECUTION

### 3.01 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
  - 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- C. Conductor Terminations and Connections:
  - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  - 2. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.03 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

3.04 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- D. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main

- water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
- 3.05 FIELD QUALITY CONTROL
- A. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed the following values:
1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
  3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 26 05 29  
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included: The Work of this Section includes, but is not limited to, the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.02 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

1.03 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.04 SUBMITTALS

- A. Product Data: For the following:
1. Steel slotted support systems.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.06 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

**PART 2 - PRODUCTS**

**2.01 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS**

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
  - 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 3. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti Inc.
      - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.

2. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
3. Toggle Bolts: All-steel springhead type.
4. Hanger Rods: Threaded steel.

#### 2.02 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

### PART 3 - EXECUTION

#### 3.01 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

#### 3.02 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  1. To Wood: Fasten with lag screws or through bolts.

2. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  3. To Existing Concrete: Expansion anchor fasteners.
  4. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that strength and anchorage requirements.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.
- 3.03 INSTALLATION OF FABRICATED METAL SUPPORTS
- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
  - B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
  - C. Field Welding: Comply with AWS D1.1/D1.1M.
- 3.04 PAINTING
- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
    1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
  - B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
  - C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION



SECTION 26 05 33  
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

a. Work Included: The Work of this Section includes, but is not limited to, the following:

2. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.02 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. NBR: Acrylonitrile-butadiene rubber.

1.03 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Qualification Data: For professional engineer and testing agency.
- D. Source quality-control test reports.

1.04 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

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**PART 2 - PRODUCTS**

**2.01 METAL CONDUIT AND TUBING**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.
  - 6. Manhattan/CDT/Cole-Flex.
  - 7. O-Z Gedney; a unit of General Signal.
  - 8. Wheatland Tube Company.
- B. Rigid Steel Conduit: ANSI C80.1.
- C. IMC: ANSI C80.6.
- D. EMT: ANSI C80.3.
- E. FMC: Zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Fittings for EMT: Steel, set-screw type.
  - 2. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

**2.02 BOXES, ENCLOSURES, AND CABINETS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman.
  - 5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  - 6. O-Z/Gedney; a unit of General Signal.
  - 7. RACO; a Hubbell Company.
  - 8. Spring City Electrical Manufacturing Company.
  - 9. Thomas & Betts Corporation.
  - 10. Walker Systems, Inc.; Wiremold Company (The).

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- B. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- F. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- G. Cabinets:
  - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  - 2. Hinged door in front cover with flush latch and concealed hinge.
  - 3. Key latch to match panelboards.
  - 4. Metal barriers to separate wiring of different systems and voltage.
  - 5. Accessory feet where required for freestanding equipment.

**2.03 SLEEVES FOR RACEWAYS**

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

**2.04 SLEEVE SEALS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advance Products & Systems, Inc.
  - 2. Calpico, Inc.
  - 3. Metraflex Co.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
  - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

2. Pressure Plates: Plastic. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### PART 3 - EXECUTION

#### 3.01 RACEWAY APPLICATION

- A. Comply with the following indoor applications, unless otherwise indicated:
  1. Exposed, Rigid steel conduit
  2. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  4. Damp or Wet Locations including kitchen: Rigid steel conduit.
  5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- B. Minimum Raceway Size: 3/4-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
  1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- E. Do not install aluminum conduits.

#### 3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
  - J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
  - K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
  - L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    2. Where otherwise required by NFPA 70.
  - M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

### 3.03 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.

- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.

#### 3.04 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

#### 3.05 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

#### 3.06 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 26 05 53  
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to, the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Warning labels and signs.
  - 4. Instruction signs.
  - 5. Equipment identification labels.
  - 6. Miscellaneous identification products.

1.02 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.03 QUALITY ASSURANCE

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

1.04 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

- B. Color for Printed Legend:
    - 1. Power Circuits: Black letters on an orange field.
    - 2. Legend: Indicate system or service and voltage, if applicable.
  - C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
  - D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
  - E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
  - F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches (50 mm) wide; compounded for outdoor use.
- 2.02 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS
- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches wide.
  - B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- 2.03 WARNING LABELS AND SIGNS
- A. Comply with NFPA 70 and 29 CFR 1910.145.
  - B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.
  - C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
  - D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inc galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
  - E. Warning label and sign shall include, but are not limited to, the following legends:
    - 1. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."



2.04 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.05 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.06 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
- C. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 APPLICATION

- A. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
  - 3. Combined Fire Alarm and Security System: Red and blue.
  - 4. Security System: Blue and yellow.
  - 5. Mechanical and Electrical Supervisory System: Green and blue.
  - 6. Telecommunication System: Green and yellow.
  - 7. Control Wiring: Green and red.
- B. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use write-on tags. Identify each ungrounded conductor according to source and circuit number.
- C. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
1. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- E. Instruction Signs:
1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- F. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
    - a. Indoor Equipment: All equipment to be labeled with engraved lamacoid fastened with mechanical fasteners. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Each panel or power equipment label shall include; panel designation, voltage and origin of power feed including panel and circuit number (black background with white lettering for normal panels).Panel directory labeling to be done after final Room number designations established
  2. Equipment to Be Labeled:
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Access doors and panels for concealed electrical items.
    - c. Disconnect switches.
    - d. Enclosed circuit breakers.
    - e. Motor starters.
    - f. Remote-controlled switches, dimmer modules, and control devices.
    - g. Voice and data cable terminal equipment.
    - h. Fire-alarm control panel and annunciators.
    - i. Monitoring and control equipment.

3.02 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
- H. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

END OF SECTION

SECTION 26 24 16  
PANELBOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to, the following:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

1.02 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.
  - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - 7. Include wiring diagrams for power, signal, and control wiring.
  - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.04 INFORMATIONAL SUBMITTALS

- A. Field Quality-Control Reports:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- B. Panelboard Schedules: For installation in panelboards.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.06 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. Keys: Two spares for each type of panelboard cabinet lock.
  2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP)  
Types: Two spares for each panelboard.
  3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.07 QUALITY ASSURANCE

- A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.09 PROJECT CONDITIONS

- A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.

- b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Construction Manager no fewer than three days in advance of proposed interruption of electric service.
  - 2. Do not proceed with interruption of electric service without Owner's written permission.
  - 3. Comply with NFPA 70E.

#### 1.10 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Panel trim (lockable) shall have "door-in-door" construction
  - 3. Finishes:

- a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
  - b. Back Boxes: Same finish as panels and trim.
4. Directory Card: Inside panelboard door, mounted in metal frame with transparent protective cover.
- B. Incoming Mains Location: Top and bottom as required by contractor.
- C. Phase, Neutral, and Ground Buses:
- 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 3. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
- 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Main and Neutral Lugs: Mechanical type.
  - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  - 4. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  - 5. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

## 2.02 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- 1. Eaton, Cutler Hammer.
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or Lugs only as indicated on the plans.

- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Plug-in circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

#### 2.03 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D; a brand of Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Circuit breaker or Lugs only as indicated on the plans.
- D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

#### 2.04 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D; a brand of Schneider Electric.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - 5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 6. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.



- c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
- d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- e. Shunt Trip: 120V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
- f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
- g. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
- h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position.
- i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## 2.05 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Mount top of trim 90 inches above finished floor unless otherwise indicated.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.

- F. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- H. Comply with NECA 1.

### 3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:

- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
  - E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 3.05 ADJUSTING
- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
  - B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
    1. Measure as directed during period of normal system loading.
    2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
    3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
    4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.
- 3.06 PROTECTION
- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 26 27 26  
WIRING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section Includes:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Tamper-resistant receptacles.
  - 3. Weather-resistant receptacles.
  - 4. Snap switches.
  - 5. Wall-switch.
  - 6. Occupancy sensors

1.03 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.06 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

**New Jersey City University: Nursing Education Center  
Renovations to Rossey Hall**

2039 John F. Kennedy Boulevard  
Jersey City, NJ 07305

**Clarke Caton Hintz  
Construction Documents**

December 4, 2017

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  2. Leviton Mfg. Company Inc. (Leviton).
  3. Pass & Seymour/Legrand (Pass & Seymour).
  4. Lutron
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.02 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  2. Devices shall comply with the requirements in this Section.

2.03 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; 5351 (single), CR5362 (duplex).
    - b. Hubbell; HBL5351 (single), HBL5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5851(single), CRB5362 (duplex)..
- B. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; TR8300.
    - b. Hubbell; HBL8300SGA.
    - c. Leviton; 8300-SGG.

- d. Pass & Seymour; TR63H.

2.04 GFCI RECEPTACLES

A. General Description:

- 1. Straight blade, feed -through type.
- 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
- 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection.
- 4. GFCI Receptacles shall have SafeLock protection. If critical components are damaged and ground fault protection is lost or if miswired, power to receptacle is disconnected.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

- 1. Products: Subject to compliance with requirements, provide the following:
  - a. Cooper; VGF20.
  - b. Hubbell; GFR5352L.
  - c. Pass & Seymour; 2095.
  - d. Leviton; 7590.

2.05 TOGGLE SWITCHES

A. Comply with NEMA WD 1, UL 20, and FS W-S-896.

B. Prewired pigtail connectors that accommodate Fed Spec requirements and switches are approved. Must be crimped and welded terminal right angle application within the connector.

C. Switches, 120/277 V, 20 A:

- 1. Products: Subject to compliance with requirements, provide the following:
  - 1) Single Pole:
    - a) Cooper; AH1221.
    - b) Hubbell; HBL1221.
    - c) Leviton; 1221-2.
    - d) Pass & Seymour; CSB20AC1.
  - 2) Two Pole:
    - a) Cooper; AH1222.
    - b) Hubbell; HBL1222.
    - c) Leviton; 1222-2.
    - d) Pass & Seymour; CSB20AC2.
  - 3) Three Way:
    - a) Cooper; AH1223.
    - b) Hubbell; HBL1223.
    - c) Leviton; 1223-2.
    - d) Pass & Seymour; CSB20AC3.

D. Pilot-Light Switches, 20 A:

1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; AH1221PL for 120.
    - b. Hubbell; HBL1201PL for 120.
    - c. Leviton; 1221-LH1.
    - d. Pass & Seymour; PS20AC1RPL for 120 V.
  
  2. Description: Single pole, with neon-lighted handle, illuminated when switch is "off."
- E. Key-Operated Switches, 120 V, 20 A:
1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; AH1221L.
    - b. Hubbell; HBL1221L.
    - c. Leviton; 1221-2L.
    - d. Pass & Seymour; PS20AC1-L.
  
  2. Description: Single pole, with factory-supplied key in lieu of switch handle.
- 2.06 DECORATOR-STYLE DEVICES
- A. Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; 6252.
    - b. Hubbell; DR15.
    - c. Leviton; 16252.
    - d. Pass & Seymour; 26252.
- B. Tamper-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; TR6252.
    - b. Hubbell; DR15TR.
    - c. Pass & Seymour; TR26252.
  
  2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
- C. Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, and UL 498.
1. Products: Subject to compliance with requirements, provide the following:
    - a. Cooper; TWRBR15.
    - b. Hubbell; DR15TR.
    - c. LevitonTRW15.

- d. Pass & Seymour; TRW26252.
  - 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section, when installed in wet and damp locations.
  - D. GFCI, Non-Feed-Through Type, Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
    - 1. Products: Subject to compliance with requirements, provide the following:
      - a. Cooper; VGF15.
      - b. Hubbell; GF15LA.
      - c. Leviton; 8599.
      - d. Pass & Seymour; 1594.
  - E. GFCI, Tamper-Resistant and Weather-Resistant Convenience Receptacles: Square face, 125 V, 20 A; comply with NEMA WD 1, NEMA WD 6 Configuration 5-15R, UL 498, and UL 943 Class A.
    - 1. Products: Subject to compliance with requirements, provide the following:
      - a. Cooper; TWRVGF15.
      - b. Hubbell; GFTR15.
      - c. Pass & Seymour; 1594TRWR.
    - 2. Description: Labeled to comply with NFPA 70, "Receptacles, Cord Connectors, and Attachment Plugs (Caps)" Article, "Tamper-Resistant Receptacles in Dwelling Units" Section.
  - F. Toggle Switches, Square Face, 120V, 20 A: Comply with NEMA WD 1, UL 20, and FS W-S-896.
    - 1. Products: Subject to compliance with requirements, provide the following:
      - a. Cooper; 7621 (single pole), 7623 (three way).
      - b. Hubbell; DS115 (single pole), DS315 (three way).
      - c. Leviton; 5621-2 (single pole), 5623-2 (three way).
      - d. Pass & Seymour; 2621 (single pole), 2623 (three way).
- 2.07 Dimmer Switches
- A. The basis of design is Lutron Wireless control, or approved equal. Other manufacturers may be considered equal if they meet the performance requirements of this specification and have received prior written approval.
  - B. Furnish and install lighting dimmers as indicated on the drawings. Each dimmer unit shall be of solid state design, with an enclosed and secured to control slider that provides for full range and continuously variable control of light intensity. Dimmers shall have the necessary wattage ratings to serve the lighting loads. Dimmers should be voltage stabilized, have built-in surge and static protection, and have power-failure memory that retains presets through power outages.



- C. Dimmers must not have any exposed fins, shall be gangable without having to break off fin sections, and must be able to operate at the rated capacity across the full ambient temperature range, including modified capacities for those ganging configurations where fin removal is required.
- D. Dimmer must have adjustable high end output limit control, or low end output limit control.
- E. All components (face plate, heat sink fin plate, end caps, spacer plates) that are necessary to gang more than one dimmer, fan speed control or any other Decorator accessory device in a single location must be available from one manufacturer.
- F. Dimmers must also feature:
  - 1. Face plates with no visible means of attachment (e.g. – screwless face plate).
  - 2. A label holder that environmentally protects a printed label that is built in to the screwless face plate.

#### 2.08 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, thermoplastic with lockable cover.

#### 2.09 FINISHES

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.
- B. Wall Plate Color: For plastic covers, match device color.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.02 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### 3.03 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.04 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 26 28 16  
ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included: The Work of this Section includes, but is not limited to, the following:
  - 1. Receptacle switches.
  - 2. Shunt trip switches.
  - 3. Molded-case circuit breakers (MCCBs).
  - 4. Molded-case switches.
  - 5. Enclosures.

1.02 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of NRTL listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.

1.04 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- B. Manufacturer's field service report.

1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.06 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.

1.08 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton, Cutler Hammer.
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D; a brand of Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- F. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - 4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  - 5. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
  - 6. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.

## 2.02 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 2. Siemens Energy & Automation, Inc.
  - 3. Square D; a brand of Schneider Electric.
- B. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- C. Features and Accessories:
  - 1. Standard frame sizes and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 4. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
  - 5. Alarm Switch: One NO contact that operates only when switch has tripped.
  - 6. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.

## 2.03 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:

- a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
  - D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
  - E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 3.05 ADJUSTING
- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION



## SECTION 265100 - LED INTERIOR LIGHTING

### PART 1 - PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:

- 1. Interior solid-state luminaires that use LED technology.
  - 2. Lighting fixture supports.

- B. Related Requirements:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
  - 2. Section 260933 "Central Dimming Controls" or Section 260936 "Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.

#### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaires.
4. Include emergency lighting units, including batteries and chargers.
5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type.
  - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing laboratory providing photometric data for luminaires.
- B. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Product Certificates: For each type of luminaire.
- D. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- E. Sample warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Lamps: Two of each type and rating installed. Furnish at least one of each type.
  2. Diffusers and Lenses: Furnish at least one of each type.

3. Globes and Guards: Furnish at least one of each type.

#### 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Recessed Fixtures: Comply with NEMA LE 4.
- C. Rated lamp life of 50,000 hours.
- D. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- E. Internal driver.
- F. Nominal Operating Voltage: 120 V ac.
  1. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

## 2.2 FIXTURE SCHEDULE

- A. Refer to the contract plans.

## 2.3 MATERIALS

- A. Metal Parts:

- 1. Free of burrs and sharp corners and edges.
- 2. Sheet metal components shall be steel unless otherwise indicated.
- 3. Form and support to prevent warping and sagging.

- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

- C. Diffusers and Globes:

- 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- 2. Glass: Annealed crystal glass unless otherwise indicated.
- 3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

- D. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.

- 1. Label shall include the following lamp characteristics:
  - a. "USE ONLY" and include specific lamp type.
  - b. Lamp diameter, shape, size, wattage, and coating.
  - c. CCT and CRI for all luminaires.

## 2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.5 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## 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 luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

### 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.

- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls or to a minimum 20 gauge backing plate attached to wall structural members.
  - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaire Support:
  - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 2. Stem-Mounted, Single-Unit Luminaires: Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

### 3.6 ADJUSTING

- A. Occupancy Adjustments: Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Architect.

**New Jersey City University: Nursing Education Center  
Renovations to Rossey Hall**  
2039 John F. Kennedy Boulevard  
Jersey City, NJ 07305

**Clarke Caton Hintz  
Construction Documents**  
December 4, 2017

END OF SECTION 265119

SECTION 283111 - FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. System smoke detectors.
  - 2. Notification appliances.

1.3 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
  - 3. Provide device FM approval label.
- B. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - 2. Include plans, elevations, sections, details, and attachments to other work.
  - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  - 4. Include voltage drop calculations for notification-appliance circuits.



5. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
6. Include performance parameters and installation details for each detector.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
  - a. Trained and certified by manufacturer in fire-alarm system design.
  - b. NICET-certified, fire-alarm technician; Level III minimum.
  - c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

- b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
- c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
- d. Riser diagram.
- e. Device addresses.
- f. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
  - 1) Equipment tested.
  - 2) Frequency of testing of installed components.
  - 3) Frequency of inspection of installed components.
  - 4) Requirements and recommendations related to results of maintenance.
  - 5) Manufacturer's user training manuals.
- g. Manufacturer's required maintenance related to system warranty requirements.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps for Strobe Units: Quantity equal to one unit.
  - 2. Smoke Detectors: Quantity equal to two units of each type.
  - 3. Detector Bases: Quantity equal to one unit of each type.
  - 4. Audible and Visual Notification Appliances: One of each type installed.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

#### 1.9 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:

1. Notify Construction Manager and Owner no fewer than 14 days in advance of proposed interruption of fire-alarm service.
  2. Do not proceed with interruption of fire-alarm service without Construction Manager and Owner's written permission.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

#### 1.10 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.
- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
  2. Warranty Period: five years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system and have the FM approval label.
- E. 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 SYSTEM SMOKE DETECTORS

- A. Shall be the same as the manufacturer of the fire alarm panel and match existing style.
- B. General Requirements for System Smoke Detectors:
  - 1. Comply with UL 268; operating at 24-V dc, nominal.
  - 2. Detectors shall be four-wire type.
  - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  - 6. Integral Visual-Indicating Light: LED type, indicating detector has operated.

## 2.3 NOTIFICATION APPLIANCES

- A. Shall be the same as the manufacturer of the fire alarm panel.
- B. General Requirements for Notification Appliances: Individually addressed, connected to a signaling-line circuit, equipped for mounting as indicated, and with screw terminals for system connections.
- C. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
  - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- D. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- E. Speakers: All speakers shall operate on 70VRMS with field selectable output taps available from 0.25 watts to 2.0 watts, with a minimum frequency response of 400 Hz to 4000 Hz.
- F. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  - 1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.

2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
  1. Comply with requirements for seismic-restraint devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Manual Fire-Alarm Boxes:
  1. Mount manual fire-alarm box on a background of a contrasting color.

2. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
  3. Install protective cover.
- D. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- E. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- F. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.

### 3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  4. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- B. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.

- C. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.

### 3.5 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 283111