

HARRIMAN

Architects + Engineers

University of Southern Maine  
25 Bedford Street  
Renovations  
Portland, ME

Project No. 11711

April 2, 2012

Issued for Bid



PROJECT MANUAL

FOR

**Renovations**

at

**University of Southern Maine  
25 BEDFORD ST.**

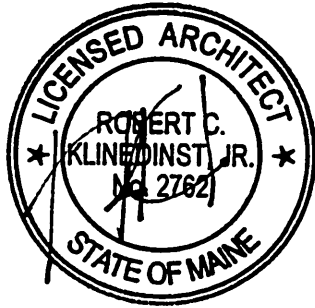
PORTLAND, MAINE

Prepared by:

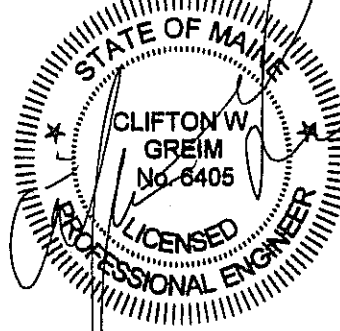
University of Southern Maine Facilities Management Department  
April 2, 2012

PROFESSIONAL SEAL PAGE

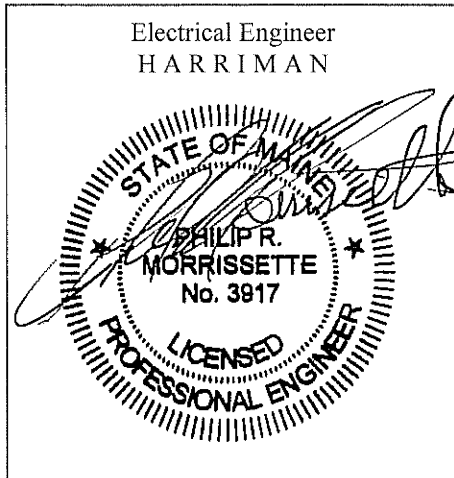
Architect  
HARRIMAN



Mechanical Engineer  
HARRIMAN



Electrical Engineer  
HARRIMAN



UNIVERSITY OF SOUTHERN MAINE  
25 BEDFORD STREET RENOVATION  
PORTLAND, MAINE

Project No. 11711

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### **Advertisement for Bids**

The University of Southern Maine, a member of the University of Maine System desires to procure construction services to renovate approximately 2,000 square feet. at 25 Bedford Street on the Portland Campus. The work requires demolition and reconstruction of walls, HVAC, electrical, plumbing, & interior finish work to make new fixed offices and open office area spaces.

**A Mandatory pre-bid meeting** and facility walk-through will be held on **April 4, 2012 at 9:00 AM** at 25 Bedford Street conference room on the Portland Campus, Portland, ME

Bidding Documents will be available on April 2, 2012, at cost of \$75.00 from Harriman - Architects + Engineers, 46 Harriman Drive, Auburn Maine. Notice to Proceed is anticipated shortly after the bid opening, and Substantial Completion is June 29, 2012.

Printed Plans and Specifications may be viewed at the Facilities Management Department (25 Bedford Street, Portland), Harriman (46 Harriman Drive, Auburn) and Harriman (123 Middle Street, Portland). All General Bidders must obtain a full set of Plans and Specifications from Harriman in order to qualify to submit a contract BID and receive any addenda. It is the responsibility of general contractors and subcontractors to review full sets of documents to ensure they have complete information to bid. Contractors who are not general contractors but who wish to receive addenda may also receive full sets.

The successful bidder will be required to furnish a 100% Performance Bond and 100% Payment Bond to cover the execution of the contract which shall be in conformity with the form of Bonds contained in Sections 00 61 13.13 and 00 61 13.16 of the Specifications and for the contract

Provide Bids in sealed envelopes plainly marked for:  
**2012-006 25 Bedford St. Renovations**  
**University of Southern Maine, Portland Campus.**

Addressed to:  
**University of Southern Maine, Portland**  
**c/o Mr. Adam Thibodeau, Project Engineer**  
**96 Falmouth Street**  
**PO Box # 9300**  
**Portland Maine. 04104-9300**

Sealed Proposals may also be hand delivered to the University of Southern Maine's Facilities Management Department, located at 25 Bedford St, Portland ME 04104. All Sealed Bids must be mailed or delivered to reach the University at the Facilities Management Department, 25 Bedford Street by **2:00 PM April 18, 2012** at which time they will be opened and read aloud. Bids received after the stated date and time will not be considered and will be returned unopened.

Bids must be accompanied by a satisfactory Bid Bond, as prescribed in Section 00 43 13, for 5% of the Bid (checks will not be accepted).

The University reserves the right to waive all formalities and reject any and all Bids or to accept any

Bid.

The University of Maine System in all its activities subscribes and adheres to the provisions of the Civil Rights Act of 1964 as amended to date. General contractors, subcontractors, and product suppliers bidding on this project must subscribe and adhere to same. There shall be no discrimination in employment because of race, national origin, religion, immigration status, handicapped status, or sex.

UNIVERSITY OF MAINE,  
**University of Southern Maine,**  
**Portland Campus**  
**Robert W. Bertram,**  
**Executive Director of Facilities Management** for  
The University of Maine System Board of Trustees

**Bid Form**

BIDDER:

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

**University of Maine University of Southern Maine, Portland Campus**  
**c/o Mr. Adam Thibodeau, Project Engineer**  
**25 Bedford Street Conference Room**  
**Portland, maine**

Having carefully examined the form of contract, general conditions and plans and specifications contained therein for **25 Bedford Street Renovations 2012-006**, as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this contract for the sum of \_\_\_\_\_ Dollars (\$\_\_\_\_\_).

Alternate prices as follows:

Alternate #1 \_\_\_\_\_ Alternate #2 \_\_\_\_\_ Alternate #3 \_\_\_\_\_

This proposal includes the cost of 100% Performance Bond plus 100% Payment Bond.

The receipt of the following addenda to plans and specifications is hereby acknowledged:

ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_      ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_  
ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_      ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_

Any material or materials not specified in the bidding document but worthy of consideration may be introduced by the bidder by a separate letter attached to this Proposal. A cost comparison must be included giving the comparison with the Material specified and the reason for the suggested substitution. The basic bid shall be as specified.

The undersigned agrees, if this bid is accepted to sign a contract and deliver it, along with the bonds and affidavits for all insurance specified within twelve (12) calendar days after the date of notification of such acceptance, except if the 12th day falls on a Saturday, Sunday or holiday, then the conditions will be fulfilled if the required documents are received before 12 o'clock noon on the day following the holiday, or the Monday following the Saturday or Sunday, and as a guarantee thereof, herewith submits a bid bond as required.

The undersigned agrees, if awarded the Contract, to complete the work on or before \_\_\_\_\_. The undersigned also agrees, if awarded the Contract, that no more than 80% of the contract amount will be sublet to other contractors.

Signed \_\_\_\_\_  
By \_\_\_\_\_  
Address \_\_\_\_\_

NOTE: If bidder is a corporation, write State of Incorporation, and if a partnership, give full names of all partners.

**UNIVERSITY OF MAINE SYSTEM**

**Construction Contract Agreement**

THIS AGREEMENT is made and entered into the \_\_\_\_ day of \_\_\_\_ 20\_\_\_\_, by and between the Contractor \*  
Contractor and Address \* and the University of Maine System acting by and through the University of Southern Maine,  
Gorham Campus, 37 College Ave. Gorham Maine 04038.

WITNESSETH: That the Owner and the Contractor for the considerations hereinafter named agree as follows:

ARTICLE 1. SCOPE OF THE WORK

The Contractor shall furnish all of the materials and perform all of the work described in the Contract Documents entitled 25 Bedford Street Renovations, prepared by Harriman Architects + Engineers dated April , 2012, acting as and in these Contract Documents entitled the Architect and/or Engineer.

ARTICLE 2: START AND TIME OF COMPLETION

The date of the commencement of work shall be the date of this Agreement or the following date \_\_\_\_ and shall be substantially completed on or before \_\_\_\_ subject to adjustments as provided in the Contract Documents.

The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the following stipulated liquidated damages for each calendar day of delay after the date established for Substantial Completion until the Work is substantially complete: not used Dollars \$not used per calendar day.

ARTICLE 3: THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract as follows \_\_\_\_ Dollars \$\_\_\_\_ subject to adjustments as provided in the Contract Documents

The Contract Sum is based upon the following alternatives and Unit Prices, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

Alternate (1) ____	Alternate (2) ____	Alternate (3) ____
Unit Prices		
Item ____	Price ____	
Item ____	Price ____	

Final payment shall be made after completion and acceptance of the work as provided in the Contract Documents.

ARTICLE 4: THE CONTRACT DOCUMENTS

The Contract Documents for this project, except for modifications issued after execution of this agreement, consist of:

- .1 This agreement.
- .2 AIA Document A201-2007, General Conditions of the Contract for Construction, as modified by University of Maine System 00 73 00.01 Supplementary Conditions to A201-2007.

- .3 The Specifications as outlined in the Project Manual (Name and date).
- .4 The Drawings as listed in the Project Manual.
- .5 The Addenda (List the addenda and dates issued).
- .6 Other documents if any (List any other documents that are intended to be part of the Contract)

ARTICLE 5: OWNER’S REPRESENTATIVES

The Owner’s Representative on this project will be Robert Bertram, who is authorized to sign contracts and other legal documents related to this project on behalf of the Owner.

The Owner’s Project Manager on this project will be Dana A. Gray.

The Owner and the Contractor hereby agree to the full performance of the covenants herein.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in triplicate on the day and year first above written.

UNIVERSITY OF MAINE SYSTEM

\_\_\_\_\_  
Company

\_\_\_\_\_  
Company

By: \_\_\_\_\_  
Signature Robert Bertram  
Executive Director of Facilities Management  
University of Maine , University of Southern  
Maine

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

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Witness

**NOTICE TO CONTRACTORS**  
(Advertisement)

The **University of Southern Maine, Portland Campus** is seeking bids for the following construction project:

**25 Bedford Street Renovations 2012-006**

Project Summary: **The University of Southern Maine, a member of the University of Maine System desires to procure construction services to renovate approximately 2,000 square feet. of 25 Bedford Street on the Portland Campus. The work requires demolition and reconstruction of walls, HVAC, electrical, plumbing, & interior finish work to make new fixed offices and open office area spaces.**

Bids will be received until **2:00 PM April 18, 2012** , at which time they will be opened and read aloud.

A **\* Mandatory \*** pre-bid meeting and building walk-through will be held at **April 4, 2012 at 9:00 AM at 25 Bedford Street conference room on the Portland Campus, Portland, ME.** Bidding contractors and subcontractors are strongly encouraged to attend.

Additional information may be obtained at: **<http://www.usm.maine.edu/facilities/current-projects>**  
**Click on 25 Bedford St. Renovations 2012-006**

**Bid Form**

BIDDER:

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

University of Maine **University of Southern Maine, Portland Campus**  
c/o **Mrs. Nancy Theriault**  
**Project Coordinator**  
**96 Falmouth Street, PO Box 9300**  
**Portland Maine 04104**

Having carefully examined the form of contract, general conditions and plans and specifications contained therein for **25 Bedford Street Renovations**, as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment and materials necessary for and reasonably incidental to the construction and completion of this contract for the sum of

\_\_\_\_\_ Dollars  
(\$ \_\_\_\_\_).

Alternate prices as follows:

Alternate #1 \_\_\_\_\_ Alternate #2 \_\_\_\_\_ Alternate #3 \_\_\_\_\_

This proposal includes the cost of 100% Performance Bond plus 100% Payment Bond.  
The receipt of the following addenda to plans and specifications is hereby acknowledged:

ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_ ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_

ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_ ADDENDUM # \_\_\_\_\_ DATED \_\_\_\_\_

Any material or materials not specified in the bidding document but worthy of consideration may be introduced by the bidder by a separate letter attached to this Proposal. A cost comparison must be included giving the comparison with the Material specified and the reason for the suggested substitution. The basic bid shall be as specified.

The undersigned agrees, if this bid is accepted to sign a contract and deliver it, along with the bonds and affidavits for all insurance specified within twelve (12) calendar days after the date of notification of such acceptance, except if the 12th day falls on a Saturday, Sunday or holiday, then the conditions will be fulfilled if the required documents are received before 12 o'clock noon on the day following the holiday, or the Monday following the Saturday or Sunday, and as a guarantee thereof, herewith submits a bid bond as required.

The undersigned agrees, if awarded the Contract, to complete the work on or before April 19, 2012. The undersigned also agrees, if awarded the Contract, that no more than 80% of the contract amount will be sublet to other contractors.

Signed \_\_\_\_\_

By \_\_\_\_\_

Address \_\_\_\_\_

NOTE: If bidder is a corporation, write State of Incorporation, and if a partnership, give full names of all partners.



**Bid Security Form**

KNOW ALL BY THESE PRESENTS, THAT WE, the undersigned, as PRINCIPAL \_\_\_\_\_ and \_\_\_\_\_ as SURETY, are hereby held and firmly bound unto the Treasurer of the UNIVERSITY OF MAINE SYSTEM in the penal sum of \_\_\_\_\_ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

The condition of the above obligation is such that whereas the Principal has submitted to \_\_\_\_\_ a certain proposal, attached hereto and hereby made a part hereof, to enter into a contract in writing for the \_\_\_\_\_.

NOW THEREFORE,

- (a) If said proposal shall be rejected, or, in the alternate
- (b) If said proposal shall be accepted and the Principal shall execute and deliver a contract in the form of contract attached hereto (properly completed in accordance with said proposal) and shall furnish a bond for faithful performance of said contract, and for the payment of all persons performing labor or furnishing material in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said proposal, then this obligation shall be void, otherwise the same shall remain in force and effect: It being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

The Surety, for value received, hereby stipulates and agrees that the obligation of said Surety and its bond shall be in no way impaired or affected by any extension of the time within which the principal may accept such proposal, further said Surety does hereby waive notice of any such extension.

In the event suit is brought upon this bond by the Treasurer of the UNIVERSITY OF MAINE SYSTEM, Surety shall pay reasonable attorneys' fees and costs incurred by the Treasurer of the UNIVERSITY OF MAINE SYSTEM in such suit.

IN WITNESS WHEREOF, the Principal and Surety have hereunto set their hands and seals, and such of them as are corporations have caused their corporate seals to be hereto affixed and these presents to be signed by their proper officers, the day and year first set above.

\_\_\_\_\_  
PRINCIPAL

By:

\_\_\_\_\_  
L.S.

\_\_\_\_\_  
SURETY

\_\_\_\_\_  
SURETY ADDRESS

By:

\_\_\_\_\_  
L.S.

**UNIVERSITY OF MAINE SYSTEM**

**Construction Contract Agreement**

THIS AGREEMENT is made and entered into the \_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_, by and between the Contractor \* Contractor and Address \* and the University of Maine System acting by and through the University of University of Southern Maine, P.O. Box 9300, Portland, ME 04104-9300.

WITNESSETH: That the Owner and the Contractor for the considerations hereinafter named agree as follows:

ARTICLE 1. SCOPE OF THE WORK

The Contractor shall furnish all of the materials and perform all of the work described in the Contract Documents entitled 25 BEDFORD STREET RENOVATIONS, prepared HARRIMAN on March 16, 2012, acting as and in these Contract Documents entitled the Architect and/or Engineer.

ARTICLE 2: START AND TIME OF COMPLETION

The date of the commencement of work shall be the date of this Agreement or the following date April 12, 2012 and shall be substantially completed on or before June 18, 2012 subject to adjustments as provided in the Contract Documents.

The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the following stipulated liquidated damages for each calendar day of delay after the date established for Substantial Completion until the Work is substantially complete: Seven Hundred Fifty Dollars \$750 per calendar day.

ARTICLE 3: THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract as follows \_\_\_\_ Dollars \$\_\_\_\_ subject to adjustments as provided in the Contract Documents

The Contract Sum is based upon the following alternatives and Unit Prices, if any, which are described in the Contract Documents and are hereby accepted by the Owner:

Alternate (1) _____	Alternate (2) _____	Alternate (3) _____
Unit Prices		
Item _____	Price _____	
Item _____	Price _____	

Final payment shall be made after completion and acceptance of the work as provided in the Contract Documents.

ARTICLE 4: THE CONTRACT DOCUMENTS

The Contract Documents for this project, except for modifications issued after execution of this agreement, consist of:

- .1 This agreement.
- .2 AIA Document A201-2007, General Conditions of the Contract for Construction, as modified by

University of Maine System 00 73 00.01 Supplementary Conditions to A201-2007.

- .3 The Specifications as outlined in the Project Manual (25 Bedford Street Renovations dated March 16, 2012).
- .4 The Drawings as listed in the Project Manual.
- .5 The Addenda (List the addenda and dates issued).
- .6 Other documents if any (List any other documents that are intended to be part of the Contract)

ARTICLE 5: OWNER'S REPRESENTATIVES

The Owner's Representative on this project will be \_\_\_\_\_, who is authorized to sign contracts and other legal documents related to this project on behalf of the Owner.

The Owner's Project Manager on this project will be \_\_\_\_\_.

The Owner and the Contractor hereby agree to the full performance of the covenants herein.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement in triplicate on the day and year first above written.

UNIVERSITY OF MAINE SYSTEM

\_\_\_\_\_  
Company

\_\_\_\_\_  
Company

By: \_\_\_\_\_  
Signature Authority Name  
Signature Authorities Title  
University of Maine \* Location \*

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

\_\_\_\_\_  
Witness

\_\_\_\_\_  
Witness

**Performance Bond Form**

Bond No. \_\_\_\_\_

KNOW ALL BY THESE PRESENTS THAT (1)\_\_\_\_\_ (2)\_\_\_\_\_ of \_\_\_\_\_ and State of \_\_\_\_\_, as PRINCIPAL, and (3) \_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_ and having a usual place of business in \_\_\_\_\_, as SURETY, are held and firmly bound unto the University of Maine System in the sum of \_\_\_\_\_ Dollars (\$\_\_\_\_\_), to be paid said Treasurer of the University of Maine System, or successor in office, for which payment well and truly to be made, Principal and Surety bind themselves, their heirs, executors and administrators, successors and assigns, jointly and severally by these presents.

The condition of this obligation is such that if the Principal shall promptly and faithfully perform the Contract entered into on the (4)\_\_\_\_\_ day of \_\_\_\_\_, A.D., 20\_\_\_\_\_ for the construction of (5)\_\_\_\_\_ then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

The Surety hereby waives notice of any alteration or extension of time made by the University of Maine System.

Signed and sealed this (4)\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

WITNESSES:

SIGNATURES:

LS

LS

LS

Bonding Company Agent:

Company:

Street:

City, State, Zip:

Telephone:

- (1.) Correct name of Contractor
- (2.) A corporation, a partnership, or an individual, as the case may be.
- (3.) Correct name of Surety
- (4.) Same date as that of contract.
- (5.) Name of Project as designated in contract.

If Contractor is partnership, all partners should execute bond. A Power of Attorney document, together with a statement that it still is in effect shall be provided by the person executing this bond. Bond must be countersigned by a Resident Maine Agent.

**\*\*DO NOT ALTER LANGUAGE\*\***

**Payment Bond Form**

Bond No. \_\_\_\_\_

KNOW ALL BY THESE PRESENTS THAT (1)\_\_\_\_\_ (2)\_\_\_\_\_ of \_\_\_\_\_ and State of \_\_\_\_\_, as Principal, and (3)\_\_\_\_\_, a corporation duly organized under the laws of the State of \_\_\_\_\_, and having a usual place of business in \_\_\_\_\_, as Surety, are held and firmly bound unto the University of Maine System in the sum of \_\_\_\_\_ Dollars (\$\_\_\_\_\_) for the use and benefit of claimants\* as herein below defined, for the payment whereof Principal and Surety bind themselves, their heirs, executors and administrators, successors and assigns, jointly and severally by these presents.

The condition of this obligation is such that if the Principal shall promptly satisfy all claims and demands incurred for all labor and materials, used or required by the Principal in connection with the work contemplated in the Contract entered into on the (4)\_\_\_\_\_ day of \_\_\_\_\_, A.D., 20\_\_\_\_\_, for the construction of (5)\_\_\_\_\_, and shall fully reimburse the obligee for all outlay and expense which said obligee may incur in making good any default of said principal, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

\*A Claimant is defined as one having a direct contract with the Principal or with a subcontractor of the Principal for labor, material, or both, used or reasonably required for use in the performance of the contract.

Signed and sealed this (6)\_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

WITNESS:

SIGNATURES”

_____	By	LS	_____
_____	By	LS	_____
_____	By	LS	_____

Bonding Company Agent:

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

Street: \_\_\_\_\_

City, State, Zip: \_\_\_\_\_

Telephone: \_\_\_\_\_

- (1.) Correct name of Contractor
- (2.) A corporation, a partnership, or an individual, as the case may be.
- (3.) Correct name of Surety
- (4.) Same date as that of contract.
- (5.) Name of Project as designated in contract.
- (6.) Same date as that of Contract.

If contractor is partnership, all partners should execute bond.

A Power of Attorney document, together with a statement that it still is in effect shall be provided by the person executing this bond.

Bond must be countersigned by a Resident Maine Agent.

**\*\*DO NOT ALTER LANGUAGE\*\***


**AIA® Document G715™ – 1991**
**Supplemental Attachment for ACORD Certificate of Insurance 25-S**
*(This document replaces AIA Document G705, Certificate of Insurance.)*
**PROJECT** (Name and address):

**INSURED** UNIVERSITY OF MAINE SYSTEM  
 16 Central Street, Bangor, ME 04401

	Yes	No	N/A
<b>A. General Liability</b>			
1. Does the General Aggregate apply to this Project only?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Does this policy include coverage for:			
a. Premises - Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Explosion, Collapse and Underground Hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Personal Injury Coverage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Products Coverage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Completed Operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Contractual Coverage for the Insured's obligations in A201?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. If coverage is written on a claims-made basis, what is the:			
a. Retroactive Date?			
b. Extended Reporting Date?			
<b>B. Worker's Compensation</b>			
1. If the Insured is exempt from Worker's Compensation statutes, does the Insured carry the equivalent Voluntary Compensation coverage?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>C. Final Payment Information</b>			
1. Is this certificate being furnished in connection with the Contractor's request for final payment in accordance with the requirements of Sections 9.10.2 and 11.1.3 of AIA Document A201, General Conditions of the Contract for Construction?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. If so, and if the policy period extends beyond termination of the Contract for Construction, is Completed Operations coverage for this Project continued for the balance of the policy period?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>D. Termination Provisions</b>			
1. Has each policy shown on the certificate and this Supplement been endorsed to provide the holder with 30 days notice of cancellation and/or expiration? List below any policies which do not contain this notice.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>E. Other Provisions</b>			

 \_\_\_\_\_  
 Authorized Representative

 \_\_\_\_\_  
 Date of Issue

**ACORD™ CERTIFICATE OF LIABILITY INSURANCE**

DATE (MM/DD/YY)

PRODUCER	THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.
	<b>INSURERS AFFORDING COVERAGE</b>
INSURED	INSURER A:
	INSURER B:
	INSURER C:
	INSURER D:
	INSURER E:

**COVERAGES**

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
	<b>GENERAL LIABILITY</b> <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS MADE <input type="checkbox"/> OCCUR  GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC				EACH OCCURRENCE	\$
					FIRE DAMAGE (Any one fire)	\$
					MED EXP (Any one person)	\$
					PERSONAL & ADV INJURY	\$
					GENERAL AGGREGATE	\$
					PRODUCTS - COMP/OP AGG	\$
	<b>AUTOMOBILE LIABILITY</b> <input type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS				COMBINED SINGLE LIMIT (Ea accident)	\$
					BODILY INJURY (Per person)	\$
					BODILY INJURY (Per accident)	\$
					PROPERTY DAMAGE (Per accident)	\$
	<b>GARAGE LIABILITY</b> <input type="checkbox"/> ANY AUTO				AUTO ONLY - EA ACCIDENT	\$
					OTHER THAN EA ACC	\$
					AUTO ONLY: AGG	\$
	<b>EXCESS LIABILITY</b> <input type="checkbox"/> OCCUR <input type="checkbox"/> CLAIMS MADE  <input type="checkbox"/> DEDUCTIBLE <input type="checkbox"/> RETENTION \$				EACH OCCURRENCE	\$
					AGGREGATE	\$
						\$
						\$
						\$
	<b>WORKERS COMPENSATION AND EMPLOYERS' LIABILITY</b>				WC STATU-TORY LIMITS	OTH-ER
					E.L. EACH ACCIDENT	\$
					E.L. DISEASE - EA EMPLOYEE	\$
					E.L. DISEASE - POLICY LIMIT	\$
	OTHER					

DESCRIPTION OF OPERATIONS/LOCATIONS/VEHICLES/EXCLUSIONS ADDED BY ENDORSEMENT/SPECIAL PROVISIONS

CERTIFICATE HOLDER

ADDITIONAL INSURED; INSURER LETTER: \_\_\_\_\_

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL \_\_\_\_\_ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE

## **IMPORTANT**

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

## **DISCLAIMER**

The Certificate of Insurance on the reverse side of this form does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.

Sample



# COMMERCIAL GENERAL LIABILITY COVERAGE FORM

Various provisions in this policy restrict coverage. Read the entire policy carefully to determine rights, duties and what is and is not covered.

Throughout this policy the words "you" and "your" refer to the Named Insured shown in the Declarations, and any other person or organization qualifying as a Named Insured under this policy. The words "we", "us" and "our" refer to the company providing this insurance.

The word "insured" means any person or organization qualifying as such under Section II – Who Is An Insured.

Other words and phrases that appear in quotation marks have special meaning. Refer to Section V – Definitions.

## SECTION I – COVERAGES

### COVERAGE A BODILY INJURY AND PROPERTY DAMAGE LIABILITY

#### 1. Insuring Agreement

a. We will pay those sums that the insured becomes legally obligated to pay as damages because of "bodily injury" or "property damage" to which this insurance applies. We will have the right and duty to defend the insured against any "suit" seeking those damages. However, we will have no duty to defend the insured against any "suit" seeking damages for "bodily injury" or "property damage" to which this insurance does not apply. We may, at our discretion, investigate any "occurrence" and settle any claim or "suit" that may result. But:

- (1) The amount we will pay for damages is limited as described in Section III – Limits Of Insurance; and
- (2) Our right and duty to defend ends when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages A or B or medical expenses under Coverage C.

No other obligation or liability to pay sums or perform acts or services is covered unless explicitly provided for under Supplementary Payments – Coverages A and B.

b. This insurance applies to "bodily injury" and "property damage" only if:

- (1) The "bodily injury" or "property damage" is caused by an "occurrence" that takes place in the "coverage territory";
- (2) The "bodily injury" or "property damage" occurs during the policy period; and
- (3) Prior to the policy period, no insured listed under Paragraph 1. of Section II – Who Is An Insured and no "employee" authorized by you to give or receive notice of an "occurrence" or claim, knew that the "bodily injury" or "property damage" had occurred, in whole or in part. If such a listed insured or authorized "employee" knew, prior to the policy period, that the "bodily injury" or "property damage" occurred, then any continuation, change or resumption of such "bodily injury" or "property damage" during or after the policy period will be deemed to have been known prior to the policy period.

c. "Bodily injury" or "property damage" which occurs during the policy period and was not, prior to the policy period, known to have occurred by any insured listed under Paragraph 1. of Section II – Who Is An Insured or any "employee" authorized by you to give or receive notice of an "occurrence" or claim, includes any continuation, change or resumption of that "bodily injury" or "property damage" after the end of the policy period.

d. "Bodily injury" or "property damage" will be deemed to have been known to have occurred at the earliest time when any insured listed under Paragraph 1. of Section II – Who Is An Insured or any "employee" authorized by you to give or receive notice of an "occurrence" or claim:

- (1) Reports all, or any part, of the "bodily injury" or "property damage" to us or any other insurer;
- (2) Receives a written or verbal demand or claim for damages because of the "bodily injury" or "property damage"; or
- (3) Becomes aware by any other means that "bodily injury" or "property damage" has occurred or has begun to occur.

- e. Damages because of "bodily injury" include damages claimed by any person or organization for care, loss of services or death resulting at any time from the "bodily injury".

## 2. Exclusions

This insurance does not apply to:

### a. Expected Or Intended Injury

"Bodily injury" or "property damage" expected or intended from the standpoint of the insured. This exclusion does not apply to "bodily injury" resulting from the use of reasonable force to protect persons or property.

### b. Contractual Liability

"Bodily injury" or "property damage" for which the insured is obligated to pay damages by reason of the assumption of liability in a contract or agreement. This exclusion does not apply to liability for damages:

- (1) That the insured would have in the absence of the contract or agreement; or
- (2) Assumed in a contract or agreement that is an "insured contract", provided the "bodily injury" or "property damage" occurs subsequent to the execution of the contract or agreement. Solely for the purposes of liability assumed in an "insured contract", reasonable attorney fees and necessary litigation expenses incurred by or for a party other than an insured are deemed to be damages because of "bodily injury" or "property damage", provided:
  - (a) Liability to such party for, or for the cost of, that party's defense has also been assumed in the same "insured contract"; and
  - (b) Such attorney fees and litigation expenses are for defense of that party against a civil or alternative dispute resolution proceeding in which damages to which this insurance applies are alleged.

### c. Liquor Liability

"Bodily injury" or "property damage" for which any insured may be held liable by reason of:

- (1) Causing or contributing to the intoxication of any person;
- (2) The furnishing of alcoholic beverages to a person under the legal drinking age or under the influence of alcohol; or
- (3) Any statute, ordinance or regulation relating to the sale, gift, distribution or use of alcoholic beverages.

This exclusion applies only if you are in the business of manufacturing, distributing, selling, serving or furnishing alcoholic beverages.

### d. Workers' Compensation And Similar Laws

Any obligation of the insured under a workers' compensation, disability benefits or unemployment compensation law or any similar law.

### e. Employer's Liability

"Bodily injury" to:

- (1) An "employee" of the insured arising out of and in the course of:
  - (a) Employment by the insured; or
  - (b) Performing duties related to the conduct of the insured's business; or
- (2) The spouse, child, parent, brother or sister of that "employee" as a consequence of Paragraph (1) above.

This exclusion applies:

- (1) Whether the insured may be liable as an employer or in any other capacity; and
- (2) To any obligation to share damages with or repay someone else who must pay damages because of the injury.

This exclusion does not apply to liability assumed by the insured under an "insured contract".

**f. Pollution**

- (1) "Bodily injury" or "property damage" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants":
- (a) At or from any premises, site or location which is or was at any time owned or occupied by, or rented or loaned to, any insured. However, this subparagraph does not apply to:
    - (i) "Bodily injury" if sustained within a building and caused by smoke, fumes, vapor or soot produced by or originating from equipment that is used to heat, cool or dehumidify the building, or equipment that is used to heat water for personal use, by the building's occupants or their guests;
    - (ii) "Bodily injury" or "property damage" for which you may be held liable, if you are a contractor and the owner or lessee of such premises, site or location has been added to your policy as an additional insured with respect to your ongoing operations performed for that additional insured at that premises, site or location and such premises, site or location is not and never was owned or occupied by, or rented or loaned to, any insured, other than that additional insured; or
    - (iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire";
  - (b) At or from any premises, site or location which is or was at any time used by or for any insured or others for the handling, storage, disposal, processing or treatment of waste;
  - (c) Which are or were at any time transported, handled, stored, treated, disposed of, or processed as waste by or for:
    - (i) Any insured; or
    - (ii) Any person or organization for whom you may be legally responsible; or
  - (d) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the "pollutants" are brought on or to the premises, site or location in connection with such operations by such insured, contractor or subcontractor. However, this subparagraph does not apply to:
    - (i) "Bodily injury" or "property damage" arising out of the escape of fuels, lubricants or other operating fluids which are needed to perform the normal electrical, hydraulic or mechanical functions necessary for the operation of "mobile equipment" or its parts, if such fuels, lubricants or other operating fluids escape from a vehicle part designed to hold, store or receive them. This exception does not apply if the "bodily injury" or "property damage" arises out of the intentional discharge, dispersal or release of the fuels, lubricants or other operating fluids, or if such fuels, lubricants or other operating fluids are brought on or to the premises, site or location with the intent that they be discharged, dispersed or released as part of the operations being performed by such insured, contractor or subcontractor;
    - (ii) "Bodily injury" or "property damage" sustained within a building and caused by the release of gases, fumes or vapors from materials brought into that building in connection with operations being performed by you or on your behalf by a contractor or subcontractor; or
    - (iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire".
  - (e) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the operations are to test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants".

**(2)** Any loss, cost or expense arising out of any:

- (a)** Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or
- (b)** Claim or "suit" by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

However, this paragraph does not apply to liability for damages because of "property damage" that the insured would have in the absence of such request, demand, order or statutory or regulatory requirement, or such claim or "suit" by or on behalf of a governmental authority.

**g. Aircraft, Auto Or Watercraft**

"Bodily injury" or "property damage" arising out of the ownership, maintenance, use or entrustment to others of any aircraft, "auto" or watercraft owned or operated by or rented or loaned to any insured. Use includes operation and "loading or unloading".

This exclusion applies even if the claims against any insured allege negligence or other wrongdoing in the supervision, hiring, employment, training or monitoring of others by that insured, if the "occurrence" which caused the "bodily injury" or "property damage" involved the ownership, maintenance, use or entrustment to others of any aircraft, "auto" or watercraft that is owned or operated by or rented or loaned to any insured.

This exclusion does not apply to:

- (1)** A watercraft while ashore on premises you own or rent;
- (2)** A watercraft you do not own that is:
  - (a)** Less than 26 feet long; and
  - (b)** Not being used to carry persons or property for a charge;
- (3)** Parking an "auto" on, or on the ways next to, premises you own or rent, provided the "auto" is not owned by or rented or loaned to you or the insured;
- (4)** Liability assumed under any "insured contract" for the ownership, maintenance or use of aircraft or watercraft; or

**(5)** "Bodily injury" or "property damage" arising out of:

- (a)** The operation of machinery or equipment that is attached to, or part of, a land vehicle that would qualify under the definition of "mobile equipment" if it were not subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged; or
- (b)** the operation of any of the machinery or equipment listed in Paragraph **f.(2)** or **f.(3)** of the definition of "mobile equipment".

**h. Mobile Equipment**

"Bodily injury" or "property damage" arising out of:

- (1)** The transportation of "mobile equipment" by an "auto" owned or operated by or rented or loaned to any insured; or
- (2)** The use of "mobile equipment" in, or while in practice for, or while being prepared for, any prearranged racing, speed, demolition, or stunting activity.

**i. War**

"Bodily injury" or "property damage", however caused, arising, directly or indirectly, out of:

- (1)** War, including undeclared or civil war;
- (2)** Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or
- (3)** Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

**j. Damage To Property**

"Property damage" to:

- (1)** Property you own, rent, or occupy, including any costs or expenses incurred by you, or any other person, organization or entity, for repair, replacement, enhancement, restoration or maintenance of such property for any reason, including prevention of injury to a person or damage to another's property;
- (2)** Premises you sell, give away or abandon, if the "property damage" arises out of any part of those premises;
- (3)** Property loaned to you;
- (4)** Personal property in the care, custody or control of the insured;

- (5) That particular part of real property on which you or any contractors or subcontractors working directly or indirectly on your behalf are performing operations, if the "property damage" arises out of those operations; or
- (6) That particular part of any property that must be restored, repaired or replaced because "your work" was incorrectly performed on it.

Paragraphs (1), (3) and (4) of this exclusion do not apply to "property damage" (other than damage by fire) to premises, including the contents of such premises, rented to you for a period of 7 or fewer consecutive days. A separate limit of insurance applies to Damage To Premises Rented To You as described in Section III – Limits Of Insurance.

Paragraph (2) of this exclusion does not apply if the premises are "your work" and were never occupied, rented or held for rental by you.

Paragraphs (3), (4), (5) and (6) of this exclusion do not apply to liability assumed under a side-track agreement.

Paragraph (6) of this exclusion does not apply to "property damage" included in the "products-completed operations hazard".

#### k. Damage To Your Product

"Property damage" to "your product" arising out of it or any part of it.

#### l. Damage To Your Work

"Property damage" to "your work" arising out of it or any part of it and included in the "products-completed operations hazard".

This exclusion does not apply if the damaged work or the work out of which the damage arises was performed on your behalf by a subcontractor.

#### m. Damage To Impaired Property Or Property Not Physically Injured

"Property damage" to "impaired property" or property that has not been physically injured, arising out of:

- (1) A defect, deficiency, inadequacy or dangerous condition in "your product" or "your work"; or
- (2) A delay or failure by you or anyone acting on your behalf to perform a contract or agreement in accordance with its terms.

This exclusion does not apply to the loss of use of other property arising out of sudden and accidental physical injury to "your product" or "your work" after it has been put to its intended use.

#### n. Recall Of Products, Work Or Impaired Property

Damages claimed for any loss, cost or expense incurred by you or others for the loss of use, withdrawal, recall, inspection, repair, replacement, adjustment, removal or disposal of:

- (1) "Your product";
- (2) "Your work"; or
- (3) "Impaired property";

if such product, work, or property is withdrawn or recalled from the market or from use by any person or organization because of a known or suspected defect, deficiency, inadequacy or dangerous condition in it.

#### o. Personal And Advertising Injury

"Bodily injury" arising out of "personal and advertising injury".

#### p. Electronic Data

Damages arising out of the loss of, loss of use of, damage to, corruption of, inability to access, or inability to manipulate electronic data.

As used in this exclusion, electronic data means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software, including systems and applications software, hard or floppy disks, CD-ROMS, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

Exclusions c. through n. do not apply to damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner. A separate limit of insurance applies to this coverage as described in Section III – Limits Of Insurance.

### COVERAGE B PERSONAL AND ADVERTISING INJURY LIABILITY

#### 1. Insuring Agreement

- a. We will pay those sums that the insured becomes legally obligated to pay as damages because of "personal and advertising injury" to which this insurance applies. We will have the right and duty to defend the insured against any "suit" seeking those damages. However, we will have no duty to defend the insured against any "suit" seeking damages for "personal and advertising injury" to which this insurance does not apply. We may, at our discretion, investigate any offense and settle any claim or "suit" that may result. But:

- (1) The amount we will pay for damages is limited as described in Section III – Limits Of Insurance; and

- (2) Our right and duty to defend end when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages **A** or **B** or medical expenses under Coverage **C**.

No other obligation or liability to pay sums or perform acts or services is covered unless explicitly provided for under Supplementary Payments – Coverages **A** and **B**.

- b. This insurance applies to "personal and advertising injury" caused by an offense arising out of your business but only if the offense was committed in the "coverage territory" during the policy period.

## 2. Exclusions

This insurance does not apply to:

### a. Knowing Violation Of Rights Of Another

"Personal and advertising injury" caused by or at the direction of the insured with the knowledge that the act would violate the rights of another and would inflict "personal and advertising injury".

### b. Material Published With Knowledge Of Falsity

"Personal and advertising injury" arising out of oral or written publication of material, if done by or at the direction of the insured with knowledge of its falsity.

### c. Material Published Prior To Policy Period

"Personal and advertising injury" arising out of oral or written publication of material whose first publication took place before the beginning of the policy period.

### d. Criminal Acts

"Personal and advertising injury" arising out of a criminal act committed by or at the direction of the insured.

### e. Contractual Liability

"Personal and advertising injury" for which the insured has assumed liability in a contract or agreement. This exclusion does not apply to liability for damages that the insured would have in the absence of the contract or agreement.

### f. Breach Of Contract

"Personal and advertising injury" arising out of a breach of contract, except an implied contract to use another's advertising idea in your "advertisement".

### g. Quality Or Performance Of Goods – Failure To Conform To Statements

"Personal and advertising injury" arising out of the failure of goods, products or services to conform with any statement of quality or performance made in your "advertisement".

### h. Wrong Description Of Prices

"Personal and advertising injury" arising out of the wrong description of the price of goods, products or services stated in your "advertisement".

### i. Infringement Of Copyright, Patent, Trademark Or Trade Secret

"Personal and advertising injury" arising out of the infringement of copyright, patent, trademark, trade secret or other intellectual property rights.

However, this exclusion does not apply to infringement, in your "advertisement", of copyright, trade dress or slogan.

### j. Insureds In Media And Internet Type Businesses

"Personal and advertising injury" committed by an insured whose business is:

- (1) Advertising, broadcasting, publishing or telecasting;
- (2) Designing or determining content of websites for others; or
- (3) An Internet search, access, content or service provider.

However, this exclusion does not apply to Paragraphs **14.a.**, **b.** and **c.** of "personal and advertising injury" under the Definitions Section.

For the purposes of this exclusion, the placing of frames, borders or links, or advertising, for you or others anywhere on the Internet, is not by itself, considered the business of advertising, broadcasting, publishing or telecasting.

### k. Electronic Chatrooms Or Bulletin Boards

"Personal and advertising injury" arising out of an electronic chatroom or bulletin board the insured hosts, owns, or over which the insured exercises control.

### l. Unauthorized Use Of Another's Name Or Product

"Personal and advertising injury" arising out of the unauthorized use of another's name or product in your e-mail address, domain name or metatag, or any other similar tactics to mislead another's potential customers.

**m. Pollution**

"Personal and advertising injury" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants" at any time.

**n. Pollution-Related**

Any loss, cost or expense arising out of any:

- (1) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or
- (2) Claim or suit by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

**o. War**

"Personal and advertising injury", however caused, arising, directly or indirectly, out of:

- (1) War, including undeclared or civil war;
- (2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or
- (3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

**COVERAGE C MEDICAL PAYMENTS****1. Insuring Agreement**

a. We will pay medical expenses as described below for "bodily injury" caused by an accident:

- (1) On premises you own or rent;
- (2) On ways next to premises you own or rent; or
- (3) Because of your operations; provided that:
  - (1) The accident takes place in the "coverage territory" and during the policy period;
  - (2) The expenses are incurred and reported to us within one year of the date of the accident; and
  - (3) The injured person submits to examination, at our expense, by physicians of our choice as often as we reasonably require.

b. We will make these payments regardless of fault. These payments will not exceed the applicable limit of insurance. We will pay reasonable expenses for:

- (1) First aid administered at the time of an accident;
- (2) Necessary medical, surgical, x-ray and dental services, including prosthetic devices; and
- (3) Necessary ambulance, hospital, professional nursing and funeral services.

**2. Exclusions**

We will not pay expenses for "bodily injury":

**a. Any Insured**

To any insured, except "volunteer workers".

**b. Hired Person**

To a person hired to do work for or on behalf of any insured or a tenant of any insured.

**c. Injury On Normally Occupied Premises**

To a person injured on that part of premises you own or rent that the person normally occupies.

**d. Workers Compensation And Similar Laws**

To a person, whether or not an "employee" of any insured, if benefits for the "bodily injury" are payable or must be provided under a workers' compensation or disability benefits law or a similar law.

**e. Athletics Activities**

To a person injured while practicing, instructing or participating in any physical exercises or games, sports, or athletic contests.

**f. Products-Completed Operations Hazard**

Included within the "products-completed operations hazard".

**g. Coverage A Exclusions**

Excluded under Coverage A.

**SUPPLEMENTARY PAYMENTS – COVERAGES A AND B**

1. We will pay, with respect to any claim we investigate or settle, or any "suit" against an insured we defend:

- a. All expenses we incur.
- b. Up to \$250 for cost of bail bonds required because of accidents or traffic law violations arising out of the use of any vehicle to which the Bodily Injury Liability Coverage applies. We do not have to furnish these bonds.

- c. The cost of bonds to release attachments, but only for bond amounts within the applicable limit of insurance. We do not have to furnish these bonds.
- d. All reasonable expenses incurred by the insured at our request to assist us in the investigation or defense of the claim or "suit", including actual loss of earnings up to \$250 a day because of time off from work.
- e. All costs taxed against the insured in the "suit".
- f. Prejudgment interest awarded against the insured on that part of the judgment we pay. If we make an offer to pay the applicable limit of insurance, we will not pay any prejudgment interest based on that period of time after the offer.
- g. All interest on the full amount of any judgment that accrues after entry of the judgment and before we have paid, offered to pay, or deposited in court the part of the judgment that is within the applicable limit of insurance.

These payments will not reduce the limits of insurance.

- 2. If we defend an insured against a "suit" and an indemnitee of the insured is also named as a party to the "suit", we will defend that indemnitee if all of the following conditions are met:
  - a. The "suit" against the indemnitee seeks damages for which the insured has assumed the liability of the indemnitee in a contract or agreement that is an "insured contract";
  - b. This insurance applies to such liability assumed by the insured;
  - c. The obligation to defend, or the cost of the defense of, that indemnitee, has also been assumed by the insured in the same "insured contract";
  - d. The allegations in the "suit" and the information we know about the "occurrence" are such that no conflict appears to exist between the interests of the insured and the interests of the indemnitee;
  - e. The indemnitee and the insured ask us to conduct and control the defense of that indemnitee against such "suit" and agree that we can assign the same counsel to defend the insured and the indemnitee; and
  - f. The indemnitee:
    - (1) Agrees in writing to:
      - (a) Cooperate with us in the investigation, settlement or defense of the "suit";

- (b) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the "suit";
  - (c) Notify any other insurer whose coverage is available to the indemnitee; and
  - (d) Cooperate with us with respect to coordinating other applicable insurance available to the indemnitee; and
- (2) Provides us with written authorization to:
    - (a) Obtain records and other information related to the "suit"; and
    - (b) Conduct and control the defense of the indemnitee in such "suit".

So long as the above conditions are met, attorneys' fees incurred by us in the defense of that indemnitee, necessary litigation expenses incurred by us and necessary litigation expenses incurred by the indemnitee at our request will be paid as Supplementary Payments. Notwithstanding the provisions of Paragraph **2.b.(2)** of Section I – Coverage A – Bodily Injury And Property Damage Liability, such payments will not be deemed to be damages for "bodily injury" and "property damage" and will not reduce the limits of insurance.

Our obligation to defend an insured's indemnitee and to pay for attorneys' fees and necessary litigation expenses as Supplementary Payments ends when:

- a. We have used up the applicable limit of insurance in the payment of judgments or settlements; or
- b. The conditions set forth above, or the terms of the agreement described in Paragraph f. above, are no longer met.

## SECTION II – WHO IS AN INSURED

- 1. If you are designated in the Declarations as:
  - a. An individual, you and your spouse are insureds, but only with respect to the conduct of a business of which you are the sole owner.
  - b. A partnership or joint venture, you are an insured. Your members, your partners, and their spouses are also insureds, but only with respect to the conduct of your business.
  - c. A limited liability company, you are an insured. Your members are also insureds, but only with respect to the conduct of your business. Your managers are insureds, but only with respect to their duties as your managers.



- d. An organization other than a partnership, joint venture or limited liability company, you are an insured. Your "executive officers" and directors are insureds, but only with respect to their duties as your officers or directors. Your stockholders are also insureds, but only with respect to their liability as stockholders.
- e. A trust, you are an insured. Your trustees are also insureds, but only with respect to their duties as trustees.
2. Each of the following is also an insured:
- a. Your "volunteer workers" only while performing duties related to the conduct of your business, or your "employees", other than either your "executive officers" (if you are an organization other than a partnership, joint venture or limited liability company) or your managers (if you are a limited liability company), but only for acts within the scope of their employment by you or while performing duties related to the conduct of your business. However, none of these "employees" or "volunteer workers" are insureds for:
- (1) "Bodily injury" or "personal and advertising injury":
    - (a) To you, to your partners or members (if you are a partnership or joint venture), to your members (if you are a limited liability company), to a co-"employee" while in the course of his or her employment or performing duties related to the conduct of your business, or to your other "volunteer workers" while performing duties related to the conduct of your business;
    - (b) To the spouse, child, parent, brother or sister of that co-"employee" or "volunteer worker" as a consequence of Paragraph (1)(a) above;
    - (c) For which there is any obligation to share damages with or repay someone else who must pay damages because of the injury described in Paragraphs (1)(a) or (b) above; or
    - (d) Arising out of his or her providing or failing to provide professional health care services.
  - (2) "Property damage" to property:
    - (a) Owned, occupied or used by,
      - (b) Rented to, in the care, custody or control of, or over which physical control is being exercised for any purpose by you, any of your "employees", "volunteer workers", any partner or member (if you are a partnership or joint venture), or any member (if you are a limited liability company).
    - b. Any person (other than your "employee" or "volunteer worker"), or any organization while acting as your real estate manager.
    - c. Any person or organization having proper temporary custody of your property if you die, but only:
      - (1) With respect to liability arising out of the maintenance or use of that property; and
      - (2) Until your legal representative has been appointed.
    - d. Your legal representative if you die, but only with respect to duties as such. That representative will have all your rights and duties under this Coverage Part.
3. Any organization you newly acquire or form, other than a partnership, joint venture or limited liability company, and over which you maintain ownership or majority interest, will qualify as a Named Insured if there is no other similar insurance available to that organization. However:
- a. Coverage under this provision is afforded only until the 90th day after you acquire or form the organization or the end of the policy period, whichever is earlier;
  - b. Coverage **A** does not apply to "bodily injury" or "property damage" that occurred before you acquired or formed the organization; and
  - c. Coverage **B** does not apply to "personal and advertising injury" arising out of an offense committed before you acquired or formed the organization.
- No person or organization is an insured with respect to the conduct of any current or past partnership, joint venture or limited liability company that is not shown as a Named Insured in the Declarations.
- ### SECTION III – LIMITS OF INSURANCE
1. The Limits of Insurance shown in the Declarations and the rules below fix the most we will pay regardless of the number of:
    - a. Insureds;
    - b. Claims made or "suits" brought; or
    - c. Persons or organizations making claims or bringing "suits".

2. The General Aggregate Limit is the most we will pay for the sum of:
  - a. Medical expenses under Coverage **C**;
  - b. Damages under Coverage **A**, except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard"; and
  - c. Damages under Coverage **B**.
3. The Products-Completed Operations Aggregate Limit is the most we will pay under Coverage **A** for damages because of "bodily injury" and "property damage" included in the "products-completed operations hazard".
4. Subject to 2. above, the Personal and Advertising Injury Limit is the most we will pay under Coverage **B** for the sum of all damages because of all "personal and advertising injury" sustained by any one person or organization.
5. Subject to 2. or 3. above, whichever applies, the Each Occurrence Limit is the most we will pay for the sum of:
  - a. Damages under Coverage **A**; and
  - b. Medical expenses under Coverage **C** because of all "bodily injury" and "property damage" arising out of any one "occurrence".
6. Subject to 5. above, the Damage To Premises Rented To You Limit is the most we will pay under Coverage **A** for damages because of "property damage" to any one premises, while rented to you, or in the case of damage by fire, while rented to you or temporarily occupied by you with permission of the owner.
7. Subject to 5. above, the Medical Expense Limit is the most we will pay under Coverage **C** for all medical expenses because of "bodily injury" sustained by any one person.

The Limits of Insurance of this Coverage Part apply separately to each consecutive annual period and to any remaining period of less than 12 months, starting with the beginning of the policy period shown in the Declarations, unless the policy period is extended after issuance for an additional period of less than 12 months. In that case, the additional period will be deemed part of the last preceding period for purposes of determining the Limits of Insurance.

#### **SECTION IV – COMMERCIAL GENERAL LIABILITY CONDITIONS**

##### **1. Bankruptcy**

Bankruptcy or insolvency of the insured or of the insured's estate will not relieve us of our obligations under this Coverage Part.

##### **2. Duties In The Event Of Occurrence, Offense, Claim Or Suit**

- a. You must see to it that we are notified as soon as practicable of an "occurrence" or an offense which may result in a claim. To the extent possible, notice should include:
  - (1) How, when and where the "occurrence" or offense took place;
  - (2) The names and addresses of any injured persons and witnesses; and
  - (3) The nature and location of any injury or damage arising out of the "occurrence" or offense.
- b. If a claim is made or "suit" is brought against any insured, you must:
  - (1) Immediately record the specifics of the claim or "suit" and the date received; and
  - (2) Notify us as soon as practicable.

You must see to it that we receive written notice of the claim or "suit" as soon as practicable.
- c. You and any other involved insured must:
  - (1) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the claim or "suit";
  - (2) Authorize us to obtain records and other information;
  - (3) Cooperate with us in the investigation or settlement of the claim or defense against the "suit"; and
  - (4) Assist us, upon our request, in the enforcement of any right against any person or organization which may be liable to the insured because of injury or damage to which this insurance may also apply.
- d. No insured will, except at that insured's own cost, voluntarily make a payment, assume any obligation, or incur any expense, other than for first aid, without our consent.

##### **3. Legal Action Against Us**

No person or organization has a right under this Coverage Part:

- a. To join us as a party or otherwise bring us into a "suit" asking for damages from an insured; or

- b.** To sue us on this Coverage Part unless all of its terms have been fully complied with.

A person or organization may sue us to recover on an agreed settlement or on a final judgment against an insured; but we will not be liable for damages that are not payable under the terms of this Coverage Part or that are in excess of the applicable limit of insurance. An agreed settlement means a settlement and release of liability signed by us, the insured and the claimant or the claimant's legal representative.

#### 4. Other Insurance

If other valid and collectible insurance is available to the insured for a loss we cover under Coverages **A** or **B** of this Coverage Part, our obligations are limited as follows:

##### a. Primary Insurance

This insurance is primary except when **b.** below applies. If this insurance is primary, our obligations are not affected unless any of the other insurance is also primary. Then, we will share with all that other insurance by the method described in **c.** below.

##### b. Excess Insurance

This insurance is excess over:

- (1) Any of the other insurance, whether primary, excess, contingent or on any other basis:
  - (a) That is Fire, Extended Coverage, Builder's Risk, Installation Risk or similar coverage for "your work";
  - (b) That is Fire insurance for premises rented to you or temporarily occupied by you with permission of the owner;
  - (c) That is insurance purchased by you to cover your liability as a tenant for "property damage" to premises rented to you or temporarily occupied by you with permission of the owner; or
  - (d) If the loss arises out of the maintenance or use of aircraft, "autos" or watercraft to the extent not subject to Exclusion **g.** of Section **I** – Coverage **A** – Bodily Injury And Property Damage Liability.
- (2) Any other primary insurance available to you covering liability for damages arising out of the premises or operations, or the products and completed operations, for which you have been added as an additional insured by attachment of an endorsement.

When this insurance is excess, we will have no duty under Coverages **A** or **B** to defend the insured against any "suit" if any other insurer has a duty to defend the insured against that "suit". If no other insurer defends, we will undertake to do so, but we will be entitled to the insured's rights against all those other insurers.

When this insurance is excess over other insurance, we will pay only our share of the amount of the loss, if any, that exceeds the sum of:

- (1) The total amount that all such other insurance would pay for the loss in the absence of this insurance; and
- (2) The total of all deductible and self-insured amounts under all that other insurance.

We will share the remaining loss, if any, with any other insurance that is not described in this Excess Insurance provision and was not bought specifically to apply in excess of the Limits of Insurance shown in the Declarations of this Coverage Part.

##### c. Method Of Sharing

If all of the other insurance permits contribution by equal shares, we will follow this method also. Under this approach each insurer contributes equal amounts until it has paid its applicable limit of insurance or none of the loss remains, whichever comes first.

If any of the other insurance does not permit contribution by equal shares, we will contribute by limits. Under this method, each insurer's share is based on the ratio of its applicable limit of insurance to the total applicable limits of insurance of all insurers.

#### 5. Premium Audit

- a. We will compute all premiums for this Coverage Part in accordance with our rules and rates.
- b. Premium shown in this Coverage Part as advance premium is a deposit premium only. At the close of each audit period we will compute the earned premium for that period and send notice to the first Named Insured. The due date for audit and retrospective premiums is the date shown as the due date on the bill. If the sum of the advance and audit premiums paid for the policy period is greater than the earned premium, we will return the excess to the first Named Insured.
- c. The first Named Insured must keep records of the information we need for premium computation, and send us copies at such times as we may request.

**6. Representations**

By accepting this policy, you agree:

- a. The statements in the Declarations are accurate and complete;
- b. Those statements are based upon representations you made to us; and
- c. We have issued this policy in reliance upon your representations.

**7. Separation Of Insureds**

Except with respect to the Limits of Insurance, and any rights or duties specifically assigned in this Coverage Part to the first Named Insured, this insurance applies:

- a. As if each Named Insured were the only Named Insured; and
- b. Separately to each insured against whom claim is made or "suit" is brought.

**8. Transfer Of Rights Of Recovery Against Others To Us**

If the insured has rights to recover all or part of any payment we have made under this Coverage Part, those rights are transferred to us. The insured must do nothing after loss to impair them. At our request, the insured will bring "suit" or transfer those rights to us and help us enforce them.

**9. When We Do Not Renew**

If we decide not to renew this Coverage Part, we will mail or deliver to the first Named Insured shown in the Declarations written notice of the non-renewal not less than 30 days before the expiration date.

If notice is mailed, proof of mailing will be sufficient proof of notice.

**SECTION V – DEFINITIONS**

1. "Advertisement" means a notice that is broadcast or published to the general public or specific market segments about your goods, products or services for the purpose of attracting customers or supporters. For the purposes of this definition:
  - a. Notices that are published include material placed on the Internet or on similar electronic means of communication; and
  - b. Regarding web-sites, only that part of a web-site that is about your goods, products or services for the purposes of attracting customers or supporters is considered an advertisement.
2. "Auto" means:
  - a. A land motor vehicle, trailer or semitrailer designed for travel on public roads, including any attached machinery or equipment; or

- b. Any other land vehicle that is subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged.

However, "auto" does not include "mobile equipment".

3. "Bodily injury" means bodily injury, sickness or disease sustained by a person, including death resulting from any of these at any time.
4. "Coverage territory" means:
  - a. The United States of America (including its territories and possessions), Puerto Rico and Canada;
  - b. International waters or airspace, but only if the injury or damage occurs in the course of travel or transportation between any places included in a. above; or
  - c. All other parts of the world if the injury or damage arises out of:
    - (1) Goods or products made or sold by you in the territory described in a. above;
    - (2) The activities of a person whose home is in the territory described in a. above, but is away for a short time on your business; or
    - (3) "Personal and advertising injury" offenses that take place through the Internet or similar electronic means of communication provided the insured's responsibility to pay damages is determined in a "suit" on the merits, in the territory described in a. above or in a settlement we agree to.
5. "Employee" includes a "leased worker". "Employee" does not include a "temporary worker".
6. "Executive officer" means a person holding any of the officer positions created by your charter, constitution, by-laws or any other similar governing document.
7. "Hostile fire" means one which becomes uncontrollable or breaks out from where it was intended to be.
8. "Impaired property" means tangible property, other than "your product" or "your work", that cannot be used or is less useful because:
  - a. It incorporates "your product" or "your work" that is known or thought to be defective, deficient, inadequate or dangerous; or
  - b. You have failed to fulfill the terms of a contract or agreement;
 if such property can be restored to use by:
  - a. The repair, replacement, adjustment or removal of "your product" or "your work"; or

- b. Your fulfilling the terms of the contract or agreement.
9. "Insured contract" means:
- a. A contract for a lease of premises. However, that portion of the contract for a lease of premises that indemnifies any person or organization for damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner is not an "insured contract";
  - b. A sidetrack agreement;
  - c. Any easement or license agreement, except in connection with construction or demolition operations on or within 50 feet of a railroad;
  - d. An obligation, as required by ordinance, to indemnify a municipality, except in connection with work for a municipality;
  - e. An elevator maintenance agreement;
  - f. That part of any other contract or agreement pertaining to your business (including an indemnification of a municipality in connection with work performed for a municipality) under which you assume the tort liability of another party to pay for "bodily injury" or "property damage" to a third person or organization. Tort liability means a liability that would be imposed by law in the absence of any contract or agreement.
- Paragraph f. does not include that part of any contract or agreement:
- (1) That indemnifies a railroad for "bodily injury" or "property damage" arising out of construction or demolition operations, within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, roadbeds, tunnel, underpass or crossing;
  - (2) That indemnifies an architect, engineer or surveyor for injury or damage arising out of:
    - (a) Preparing, approving, or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or
    - (b) Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage; or
  - (3) Under which the insured, if an architect, engineer or surveyor, assumes liability for an injury or damage arising out of the insured's rendering or failure to render professional services, including those listed in (2) above and supervisory, inspection, architectural or engineering activities.
10. "Leased worker" means a person leased to you by a labor leasing firm under an agreement between you and the labor leasing firm, to perform duties related to the conduct of your business. "Leased worker" does not include a "temporary worker".
11. "Loading or unloading" means the handling of property:
- a. After it is moved from the place where it is accepted for movement into or onto an aircraft, watercraft or "auto";
  - b. While it is in or on an aircraft, watercraft or "auto"; or
  - c. While it is being moved from an aircraft, watercraft or "auto" to the place where it is finally delivered;
- but "loading or unloading" does not include the movement of property by means of a mechanical device, other than a hand truck, that is not attached to the aircraft, watercraft or "auto".
12. "Mobile equipment" means any of the following types of land vehicles, including any attached machinery or equipment:
- a. Bulldozers, farm machinery, forklifts and other vehicles designed for use principally off public roads;
  - b. Vehicles maintained for use solely on or next to premises you own or rent;
  - c. Vehicles that travel on crawler treads;
  - d. Vehicles, whether self-propelled or not, maintained primarily to provide mobility to permanently mounted:
    - (1) Power cranes, shovels, loaders, diggers or drills; or
    - (2) Road construction or resurfacing equipment such as graders, scrapers or rollers;
  - e. Vehicles not described in a., b., c. or d. above that are not self-propelled and are maintained primarily to provide mobility to permanently attached equipment of the following types:
    - (1) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment; or
    - (2) Cherry pickers and similar devices used to raise or lower workers;
  - f. Vehicles not described in a., b., c. or d. above maintained primarily for purposes other than the transportation of persons or cargo.
- However, self-propelled vehicles with the following types of permanently attached equipment are not "mobile equipment" but will be considered "autos":

- (1) Equipment designed primarily for:
- (a) Snow removal;
  - (b) Road maintenance, but not construction or resurfacing; or
  - (c) Street cleaning;
- (2) Cherry pickers and similar devices mounted on automobile or truck chassis and used to raise or lower workers; and
- (3) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment.

However, "mobile equipment" does not include any land vehicles that are subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged. Land vehicles subject to a compulsory or financial responsibility law or other motor vehicle insurance law are considered "autos".

13. "Occurrence" means an accident, including continuous or repeated exposure to substantially the same general harmful conditions.
14. "Personal and advertising injury" means injury, including consequential "bodily injury", arising out of one or more of the following offenses:
- a. False arrest, detention or imprisonment;
  - b. Malicious prosecution;
  - c. The wrongful eviction from, wrongful entry into, or invasion of the right of private occupancy of a room, dwelling or premises that a person occupies, committed by or on behalf of its owner, landlord or lessor;
  - d. Oral or written publication, in any manner, of material that slanders or libels a person or organization or disparages a person's or organization's goods, products or services;
  - e. Oral or written publication, in any manner, of material that violates a person's right of privacy;
  - f. The use of another's advertising idea in your "advertisement"; or
  - g. Infringing upon another's copyright, trade dress or slogan in your "advertisement".
15. "Pollutants" mean any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste. Waste includes materials to be recycled, reconditioned or reclaimed.

16. "Products-completed operations hazard":

- a. Includes all "bodily injury" and "property damage" occurring away from premises you own or rent and arising out of "your product" or "your work" except:

- (1) Products that are still in your physical possession; or
- (2) Work that has not yet been completed or abandoned. However, "your work" will be deemed completed at the earliest of the following times:
  - (a) When all of the work called for in your contract has been completed.
  - (b) When all of the work to be done at the job site has been completed if your contract calls for work at more than one job site.
  - (c) When that part of the work done at a job site has been put to its intended use by any person or organization other than another contractor or subcontractor working on the same project.

Work that may need service, maintenance, correction, repair or replacement, but which is otherwise complete, will be treated as completed.

- b. Does not include "bodily injury" or "property damage" arising out of:
- (1) The transportation of property, unless the injury or damage arises out of a condition in or on a vehicle not owned or operated by you, and that condition was created by the "loading or unloading" of that vehicle by any insured;
  - (2) The existence of tools, uninstalled equipment or abandoned or unused materials; or
  - (3) Products or operations for which the classification, listed in the Declarations or in a policy schedule, states that products-completed operations are subject to the General Aggregate Limit.

17. "Property damage" means:

- a. Physical injury to tangible property, including all resulting loss of use of that property. All such loss of use shall be deemed to occur at the time of the physical injury that caused it; or

- b.** Loss of use of tangible property that is not physically injured. All such loss of use shall be deemed to occur at the time of the "occurrence" that caused it.

For the purposes of this insurance, electronic data is not tangible property.

As used in this definition, electronic data means information, facts or programs stored as or on, created or used on, or transmitted to or from computer software, including systems and applications software, hard or floppy disks, CD-ROMS, tapes, drives, cells, data processing devices or any other media which are used with electronically controlled equipment.

- 18.** "Suit" means a civil proceeding in which damages because of "bodily injury", "property damage" or "personal and advertising injury" to which this insurance applies are alleged. "Suit" includes:
  - a.** An arbitration proceeding in which such damages are claimed and to which the insured must submit or does submit with our consent; or
  - b.** Any other alternative dispute resolution proceeding in which such damages are claimed and to which the insured submits with our consent.
- 19.** "Temporary worker" means a person who is furnished to you to substitute for a permanent "employee" on leave or to meet seasonal or short-term workload conditions.
- 20.** "Volunteer worker" means a person who is not your "employee", and who donates his or her work and acts at the direction of and within the scope of duties determined by you, and is not paid a fee, salary or other compensation by you or anyone else for their work performed for you.

**21.** "Your product":

**a.** Means:

- (1)** Any goods or products, other than real property, manufactured, sold, handled, distributed or disposed of by:
  - (a)** You;
  - (b)** Others trading under your name; or
  - (c)** A person or organization whose business or assets you have acquired; and
- (2)** Containers (other than vehicles), materials, parts or equipment furnished in connection with such goods or products.

**b.** Includes

- (1)** Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your product"; and
  - (2)** The providing of or failure to provide warnings or instructions.
- c.** Does not include vending machines or other property rented to or located for the use of others but not sold.

**22.** "Your work":

**a.** Means:

- (1)** Work or operations performed by you or on your behalf; and
- (2)** Materials, parts or equipment furnished in connection with such work or operations.

**b.** Includes

- (1)** Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your work", and
- (2)** The providing of or failure to provide warnings or instructions.

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY  
CG 20 10 07 04

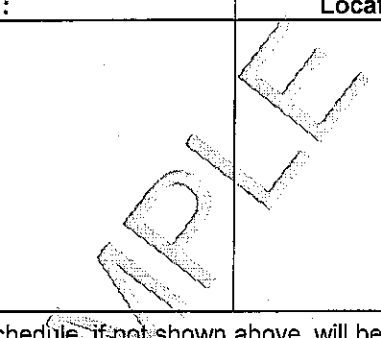
THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR  
CONTRACTORS – SCHEDULED PERSON OR  
ORGANIZATION**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

**SCHEDULE**

Name Of Additional Insured Person(s) Or Organization(s):	Location(s) Of Covered Operations
	
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

**A. Section II – Who Is An Insured** is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury", "property damage" or "personal and advertising injury" caused, in whole or in part, by:

1. Your acts or omissions; or
2. The acts or omissions of those acting on your behalf;

in the performance of your ongoing operations for the additional insured(s) at the location(s) designated above.

**B.** With respect to the insurance afforded to these additional insureds, the following additional exclusions apply:

This insurance does not apply to "bodily injury" or "property damage" occurring after:

1. All work, including materials, parts or equipment furnished in connection with such work, on the project (other than service, maintenance or repairs) to be performed by or on behalf of the additional insured(s) at the location of the covered operations has been completed; or
2. That portion of "your work" out of which the injury or damage arises has been put to its intended use by any person or organization other than another contractor or subcontractor engaged in performing operations for a principal as a part of the same project.



POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY  
CG 20 37 07 04**THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.****ADDITIONAL INSURED – OWNERS, LESSEES OR  
CONTRACTORS – COMPLETED OPERATIONS**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

**SCHEDULE**

Name Of Additional Insured Person(s) Or Organization(s):	Location And Description Of Completed Operations
Information required to complete this Schedule, if not shown above, will be shown in the Declarations.	

**Section II – Who Is An Insured** is amended to include as an additional insured the person(s) or organization(s) shown in the Schedule, but only with respect to liability for "bodily injury" or "property damage" caused, in whole or in part, by "your work" at the location designated and described in the schedule of this endorsement performed for that additional insured and included in the "products-completed operations hazard".

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY  
CG 25 04 03 97

**THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.**

## **DESIGNATED LOCATION(S) GENERAL AGGREGATE LIMIT**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

### **SCHEDULE**

<b>Designated Location(s):</b>

(If no entry appears above, information required to complete this endorsement will be shown in the Declarations as applicable to this endorsement.)

- A.** For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under **COVERAGE A (SECTION I)**, and for all medical expenses caused by accidents under **COVERAGE C (SECTION I)**, which can be attributed only to operations at a single designated "location" shown in the Schedule above:
1. A separate Designated Location General Aggregate Limit applies to each designated "location", and that limit is equal to the amount of the General Aggregate Limit shown in the Declarations.
  2. The Designated Location General Aggregate Limit is the most we will pay for the sum of all damages under **COVERAGE A**, except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard", and for medical expenses under **COVERAGE C** regardless of the number of:
    - a. Insureds;
    - b. Claims made or "suits" brought; or
    - c. Persons or organizations making claims or bringing "suits".
  3. Any payments made under **COVERAGE A** for damages or under **COVERAGE C** for medical expenses shall reduce the Designated Location General Aggregate Limit for that designated "location". Such payments shall not reduce the General Aggregate Limit shown in the Declarations nor shall they reduce any other Designated Location General Aggregate Limit for any other designated "location" shown in the Schedule above.
  4. The limits shown in the Declarations for Each Occurrence, Fire Damage and Medical Expense continue to apply. However, instead of being subject to the General Aggregate Limit shown in the Declarations, such limits will be subject to the applicable Designated Location General Aggregate Limit.

- B.** For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under **COVERAGES A** (SECTION I), and for all medical expenses caused by accidents under **COVERAGES C** (SECTION I), which cannot be attributed only to operations at a single designated "location" shown in the Schedule above:
1. Any payments made under **COVERAGES A** for damages or under **COVERAGES C** for medical expenses shall reduce the amount available under the General Aggregate Limit or the Products-Completed Operations Aggregate Limit, whichever is applicable; and
  2. Such payments shall not reduce any Designated Location General Aggregate Limit.
- C.** When coverage for liability arising out of the "products-completed operations hazard" is provided, any payments for damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard" will reduce the Products-Completed Operations Aggregate Limit, and not reduce the General Aggregate Limit nor the Designated Location General Aggregate Limit.
- D.** For the purposes of this endorsement, the **Definitions** Section is amended by the addition of the following definition:
- "Location" means premises involving the same or connecting lots, or premises whose connection is interrupted only by a street, roadway, waterway or right-of-way of a railroad.
- E.** The provisions of Limits Of Insurance (SECTION III) not otherwise modified by this endorsement shall continue to apply as stipulated.

Sample





# AIA® Document G702™ – 1992

## Application and Certificate for Payment

<b>TO OWNER:</b> University of Maine System 16 Central Street, Bangor, ME 04401-5106	<b>PROJECT:</b> University of Maine System Project	<b>APPLICATION NO:</b> 001  <b>PERIOD TO:</b> <b>CONTRACT FOR:</b> <b>CONTRACT DATE:</b> <b>PROJECT NOS:</b> / /	<b>Distribution to:</b> OWNER:  ARCHITECT:  CONTRACTOR:  FIELD:  OTHER:
<b>FROM CONTRACTOR:</b>	<b>VIA ARCHITECT:</b>		

### CONTRACTOR'S APPLICATION FOR PAYMENT

Application is made for payment, as shown below, in connection with the Contract. Continuation Sheet, AIA Document G703, is attached.

1. ORIGINAL CONTRACT SUM .....	\$	0.00
2. NET CHANGE BY CHANGE ORDERS .....	\$	0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2) .....	\$	0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) .....	\$	0.00
<b>5. RETAINAGE:</b>		
a. 0 % of Completed Work (Column D + E on G703)	\$	0.00
b. 0 % of Stored Material (Column F on G703)	\$	0.00
Total Retainage (Lines 5a + 5b or Total in Column I of G703) .....	\$	0.00
6. TOTAL EARNED LESS RETAINAGE .....	\$	0.00
(Line 4 Less Line 5 Total)		
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT .....	\$	0.00
(Line 6 from prior Certificate)		
8. CURRENT PAYMENT DUE .....	\$	0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE .....	\$	0.00
(Line 3 less Line 6)		

CHANGE ORDER SUMMARY	ADDITIONS	DEDUCTIONS
Total changes approved in previous months by Owner	\$ 0.00	\$ 0.00
Total approved this Month	\$ 0.00	\$ 0.00
<b>TOTALS</b>	<b>\$ 0.00</b>	<b>\$ 0.00</b>
NET CHANGES by Change Order	\$	0.00

The undersigned Contractor certifies that to the best of the Contractor's knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by the Contractor for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

**CONTRACTOR:**

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

State of: \_\_\_\_\_

County of: \_\_\_\_\_

Subscribed and sworn to before  
me this \_\_\_\_\_ day of \_\_\_\_\_

Notary Public:

My Commission expires: \_\_\_\_\_

### ARCHITECT'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising this application, the Architect certifies to the Owner that to the best of the Architect's knowledge, information and belief the Work has progressed as indicated, the quality of the Work is in accordance with the Contract Documents, and the Contractor is entitled to payment of the AMOUNT CERTIFIED.

AMOUNT CERTIFIED ..... \$ 0.00

*(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)*

**ARCHITECT:**

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

This Certificate is not negotiable. The AMOUNT CERTIFIED is payable only to the Contractor named herein. Issuance, payment and acceptance of payment are without prejudice to any rights of the Owner or Contractor under this Contract.

**Sales Tax Form**

Date \_\_\_\_\_

TO: \_\_\_\_\_  
Vendor Name

\_\_\_\_\_  
Vendor Address

\_\_\_\_\_  
Vendor City State Zip

I hereby certify under penalties of perjury, that:

I am engaged in the performance of a construction contract on a project for the University of Maine System which is a Sales Tax exempt organization under the Maine Sales and Use Tax Law, Section 1760, subsection 2 and 16;

This Project is titled: USM 25 Bedford Street Renovations  
Project Title

This project is located at: University of Southern Maine, Portland, ME  
Campus Name or Town

This certificate is issued to cover purchases of materials that will be permanently incorporated into the real property belonging to the exempt organization or government agency indicated above.

Signed: \_\_\_\_\_  
Authorized Signature

FIRM \_\_\_\_\_  
\_\_\_\_\_



# AIA<sup>®</sup> Document G707A<sup>™</sup> – 1994

## Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: *(Name and address)*  
University of Maine System  
Project

ARCHITECT'S PROJECT NUMBER:

OWNER:

ARCHITECT:

CONTRACT FOR:

CONTRACTOR:

TO OWNER: *(Name and address)*  
University of Maine System  
16 Central Street  
Bangor, ME 04401-5106

CONTRACT DATED:

SURETY:

OTHER:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the  
*(Insert name and address of Surety)*

on bond of  
*(Insert name and address of Contractor)*

, SURETY,

hereby approves the reduction in or partial release of retainage to the Contractor as follows:

, CONTRACTOR,

The Surety agrees that such reduction in or partial release of retainage to the Contractor shall not relieve the Surety of any of its obligations to  
*(Insert name and address of Owner)*

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:  
*(Insert in writing the month followed by the numeric date and year.)*

\_\_\_\_\_  
*(Surety)*

\_\_\_\_\_  
*(Signature of authorized representative)*

Attest:  
(Seal):

\_\_\_\_\_  
*(Printed name and title)*

**STORED MATERIALS**

University of Maine University of Southern  
 Maine  
 P.O. Box 9300, Portland, ME 04104-9300

Project Title: USM 25 Bedford Street Renovation  
 Location: Portland, ME  
 Contractor: \_\_\_\_\_

Materials and/or equipment (hereinafter "Materials") that have not yet been incorporated into the work may be delivered and suitably stored, at the site or some other location agreed upon by the Owner. The Materials listed below have been estimated at 100% of the cost and will be stored at \_\_\_\_\_. The Owner will reimburse the Contractor based upon the prices included on the Schedule of Values Form, 00 62 73(AIA G703), less the cost of installation. The Contractor must complete sufficient copies of this Stored Materials Form, 00 62 79, to accompany the Application for Payment. The Contractor shall secure the signature of its bonding company on all forms and shall also provide a Power of Attorney from the bonding company.

**SCHEDULE**

Qty	Material/Equipment	Item in AIA G703		Unit Wholesale Price	Extended Wholesale Price
		Item No	Unit Price		
<b>Total</b>					

Surety \_\_\_\_\_  
**Power of Attorney Must be Attached**

By: \_\_\_\_\_  
 Attorney-in-Fact

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

**BILL OF SALE**

The Contractor, \_\_\_\_\_, (will store/has stored) certain Materials (at the site of this project/at an approved warehouse/at bonded warehouse) and will be paid in accordance with the provisions of the General Conditions of the Contract for Construction. In consideration of the sum of \$\_\_\_\_\_ paid to the contractor by the Owner, and, in compliance with the provisions of the Contract, and, with the intention to be legally bound, the Contractor does hereby grant, bargain, sell and deliver unto the Owner, its successors and assigns, all and singular, the Materials described in the schedule above. The Contractor agrees that:

1. Contractor has good title to the Materials, free and clear of all liens and encumbrances, and title is granted to the Owner;
2. The Materials will be used only in the construction of the above referenced project, under the provisions of the Contract, and will not be diverted elsewhere without the prior written consent of the Owner;
3. The Materials have been delivered to and are at the places approved for storage, and they are clearly marked and identified as the property of the Owner and are stored in a safe and secure manner to protect from damage or loss;



4. The Contractor will pay all expenses in connection with the sale, delivery, storage, protection and insurance of Materials granted to the Owner.
5. The Contractor will remain responsible for the Materials, which will remain under its custody and control for all losses, and will fully indemnify the Owner for the cost of the Materials should the Materials be lost or damaged or stolen, regardless of exclusions in insurance policies required under this document. The contractor has insured the Materials against loss or damage by fire (with extended coverage), theft and burglary, with loss payable to the Owner;
6. The Contractor agrees that the quantities of Materials set forth in the Schedule of Values Form represents the maximum quantities for which it may be entitled to payment under the provisions of the contract;
7. The following information is included with this form:
  - (1) An Application for Payment;
  - (2) An invoice or copy of an invoice for Materials stored;
  - (3) Evidence of payment, or when payment has not been made, a letter on the Contractor's letterhead authorizing payment to be made jointly to the Contractor and the Supplier;
  - (4) Photographs showing the stored Materials and its location;
  - (5) a fire and theft insurance policy rider for the stored Materials.
  - (6) a warehouseman's receipt acknowledging that the Materials being stored at the warehouse are being held for the benefit of the Contractor or/or University.

Witness:

\_\_\_\_\_

By: \_\_\_\_\_ (SEAL)  
Principal/Contractor-Individual

Witness:

\_\_\_\_\_  
Principal/Contractor-Individual

\_\_\_\_\_

\_\_\_\_\_ (SEAL)

\_\_\_\_\_

\_\_\_\_\_ (SEAL)

\_\_\_\_\_

\_\_\_\_\_ (SEAL)

\_\_\_\_\_

\_\_\_\_\_ (SEAL)

Attest:

\_\_\_\_\_  
Principal/Contractor-Corporation

\_\_\_\_\_

Secretary

By: \_\_\_\_\_  
President


**AIA<sup>®</sup> Document G716™ – 2004**
**Request for Information (“RFI”)**


---

**TO:**
**FROM:**
**PROJECT:**

University of Maine System Project

**ISSUE DATE:**
**RFI No.** 001

**PROJECT NUMBERS:** /

**REQUESTED REPLY DATE:**
**COPIES TO:**


---

**RFI DESCRIPTION:** *(Fully describe the question or type of information requested.)*
**REFERENCES/ATTACHMENTS:** *(List specific documents researched when seeking the information requested.)*
**SPECIFICATIONS:**
**DRAWINGS:**
**OTHER:**
**SENDER’S RECOMMENDATION:** *(If RFI concerns a site or construction condition, the sender may provide a recommended solution, including cost and/or schedule considerations.)*


---

**RECEIVER’S REPLY:** *(Provide answer to RFI, including cost and/or schedule considerations.)*


---



---

**BY**
**DATE**
**COPIES TO**


---

**Note:** This reply is not an authorization to proceed with work involving additional cost, time or both. If any reply requires a change to the Contract Documents, a Change Order, Construction Change Directive or a Minor Change in the work must be executed in accordance with the Contract Documents.


**AIA Document G710™ – 1992**
**Architect's Supplemental Instructions**

**PROJECT** *(Name and address):*  
University of Maine System Project

**ARCHITECT'S SUPPLEMENTAL  
INSTRUCTION NO:**

OWNER:

ARCHITECT:

CONSULTANT:

CONTRACTOR:

FIELD:

OTHER:

**OWNER** *(Name and address):*  
University of Maine System  
16 Central Street  
Bangor, ME 04401-5106

**DATE OF ISSUANCE:**

**CONTRACT FOR:**

**FROM ARCHITECT** *(Name and  
address):*

**CONTRACT DATE:**

**TO CONTRACTOR** *(Name and  
address):*

**ARCHITECT'S PROJECT NUMBER:**

The Work shall be carried out in accordance with the following supplemental instructions issued in accordance with the Contract Documents without change in Contract Sum or Contract Time. Proceeding with the Work in accordance with these instructions indicates your acknowledgment that there will be no change in the Contract Sum or Contract Time.

**DESCRIPTION:**

**ATTACHMENTS:**

*(Here insert listing of documents that support description.)*

**ISSUED BY THE ARCHITECT:**

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

\_\_\_\_\_  
*(Printed name and title)*



# AIA® Document G714™ – 2007

## Construction Change Directive

<b>PROJECT:</b> <i>(Name and address)</i>	<b>DIRECTIVE NUMBER:</b>	<b>OWNER:</b> <input type="checkbox"/>
University of Maine	<b>DATE:</b>	<b>ARCHITECT:</b> <input type="checkbox"/>
System Project	<b>CONTRACT FOR:</b>	<b>CONSULTANT:</b> <input type="checkbox"/>
<b>TO CONTRACTOR:</b> <i>(Name and address)</i>	<b>CONTRACT DATED:</b>	<b>CONTRACTOR:</b> <input type="checkbox"/>
	<b>ARCHITECT'S PROJECT NUMBER:</b>	<b>FIELD:</b> <input type="checkbox"/>
		<b>OTHER:</b> <input type="checkbox"/>

You are hereby directed to make the following change(s) in this Contract:  
*(Describe briefly any proposed changes or list any attached information in the alternative)*

### PROPOSED ADJUSTMENTS

- The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
  - Lump Sum decrease of \$0.00
  - Unit Price of \$ \_\_\_\_\_ per \_\_\_\_\_
  - As provided in Section 7.3.3 of AIA Document A201-2007
  - As follows:

- The Contract Time is proposed to ( \_\_\_\_\_ ). The proposed adjustment, if any, is \_\_\_\_\_ days.

When signed by the Owner and Architect and received by the Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and the Contractor shall proceed with the change(s) described above.

Contractor signature indicates agreement with the proposed adjustments in Contract Sum and Contract Time set forth in this CCD.

<b>ARCHITECT</b> <i>(Firm name)</i>	<b>OWNER</b> <i>(Firm name)</i>	<b>CONTRACTOR</b> <i>(Firm name)</i>
_____	_____	_____
<b>ADDRESS</b>	<b>ADDRESS</b>	<b>ADDRESS</b>
_____	_____	_____
<b>BY</b> <i>(Signature)</i>	<b>BY</b> <i>(Signature)</i>	<b>BY</b> <i>(Signature)</i>
_____	_____	_____
<i>(Typed name)</i>	<i>(Typed name)</i>	<i>(Typed name)</i>
_____	_____	_____
<b>DATE</b>	<b>DATE</b>	<b>DATE</b>


**AIA Document G709™ – 2001**
**Work Changes Proposal Request**

**PROJECT** *(Name and address):*  
University of Maine  
System Project

**OWNER** *(Name and address):*

**FROM ARCHITECT** *(Name and address):*

**PROPOSAL REQUEST NUMBER:**

**DATE OF ISSUANCE:**

**CONTRACT FOR:**

**CONTRACT DATE:**

**ARCHITECT'S PROJECT NUMBER:**

OWNER:

ARCHITECT:

CONSULTANT:

CONTRACTOR:

FIELD:

OTHER:

**TO CONTRACTOR** *(Name and address):*

Please submit an itemized proposal for changes in the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. Within ( ) days, the Contractor must submit this proposal or notify the Architect, in writing, of the date on which proposal submission is anticipated.

**THIS IS NOT A CHANGE ORDER, A CONSTRUCTION CHANGE DIRECTIVE OR A DIRECTION TO PROCEED WITH THE WORK DESCRIBED IN THE PROPOSED MODIFICATIONS.**

**DESCRIPTION** *(Insert a written description of the Work):*

**ATTACHMENTS** *(List attached documents that support description):*

**REQUESTED BY THE ARCHITECT:**

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

\_\_\_\_\_  
*(Printed name and title)*



# AIA Document G701™ – 2001

## Change Order

<b>PROJECT</b> <i>(Name and address):</i> University of Maine System Project	<b>CHANGE ORDER NUMBER:</b> <b>DATE:</b>	<b>OWNER:</b> <input type="checkbox"/>
<b>TO CONTRACTOR</b> <i>(Name and address):</i>	<b>ARCHITECT'S PROJECT NUMBER:</b> <b>CONTRACT DATE:</b> <b>CONTRACT FOR:</b>	<b>ARCHITECT:</b> <input type="checkbox"/> <b>CONTRACTOR:</b> <input type="checkbox"/> <b>FIELD:</b> <input type="checkbox"/> <b>OTHER:</b> <input type="checkbox"/>

### THE CONTRACT IS CHANGED AS FOLLOWS:

*(Include, where applicable, any undisputed amount attributable to previously executed Construction Change Directives)*

The original Contract Sum was	\$	0.00
The net change by previously authorized Change Orders	\$	0.00
The Contract Sum prior to this Change Order was	\$	0.00
The Contract Sum will be increased by this Change Order in the amount of	\$	0.00
The new Contract Sum including this Change Order will be	\$	0.00

The Contract Time will be increased by Zero (0) days.

The date of Substantial Completion as of the date of this Change Order therefore is

**NOTE:** This Change Order does not include changes in the Contract Sum, Contract Time or Guaranteed Maximum Price which have been authorized by Construction Change Directive until the cost and time have been agreed upon by both the Owner and Contractor, in which case a Change Order is executed to supersede the Construction Change Directive.

**NOT VALID UNTIL SIGNED BY THE ARCHITECT, CONTRACTOR AND OWNER.**

_____ <b>ARCHITECT</b> <i>(Firm name)</i>	_____ <b>CONTRACTOR</b> <i>(Firm name)</i>	_____ <b>OWNER</b> <i>(Firm name)</i>
_____ <b>ADDRESS</b>	_____ <b>ADDRESS</b>	_____ <b>ADDRESS</b>
_____ <b>BY</b> <i>(Signature)</i>	_____ <b>BY</b> <i>(Signature)</i>	_____ <b>BY</b> <i>(Signature)</i>
_____ <i>(Typed name)</i>	_____ <i>(Typed name)</i>	_____ <i>(Typed name)</i>
_____ <b>DATE</b>	_____ <b>DATE</b>	_____ <b>DATE</b>


**AIA<sup>®</sup> Document G704<sup>™</sup> – 2000**
**Certificate of Substantial Completion**

**PROJECT:**  
(Name and address):  
University of Maine System Project

**PROJECT NUMBER:** /  
**CONTRACT FOR:** General Construction  
**CONTRACT DATE:**

OWNER: ARCHITECT: CONTRACTOR: FIELD: OTHER: 

**TO OWNER:**  
(Name and address):  
University of Maine System  
16 Central Street  
Bangor, ME 04401-5106

**TO CONTRACTOR:**  
(Name and address):

**PROJECT OR PORTION OF THE PROJECT DESIGNATED FOR PARTIAL OCCUPANCY OR USE SHALL INCLUDE:**

The Work performed under this Contract has been reviewed and found, to the Architect's best knowledge, information and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated above is the date of issuance established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

**Warranty**

**Date of Commencement**

\_\_\_\_\_  
ARCHITECT

\_\_\_\_\_  
BY

\_\_\_\_\_  
DATE OF ISSUANCE

A list of items to be completed or corrected is attached hereto. The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment.

**Cost estimate of Work that is incomplete or defective:** \$0.00

The Contractor will complete or correct the Work on the list of items attached hereto within Zero (0) days from the above date of Substantial Completion.

\_\_\_\_\_  
CONTRACTOR

\_\_\_\_\_  
BY

\_\_\_\_\_  
DATE

The Owner accepts the Work or designated portion as substantially complete and will assume full possession at \_\_\_\_\_ (time) on \_\_\_\_\_ (date).

\_\_\_\_\_  
OWNER

\_\_\_\_\_  
BY

\_\_\_\_\_  
DATE

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:

(Note: Owner's and Contractor's legal and insurance counsel should determine and review insurance requirements and coverage.)

**University of Maine System  
Certificate of Completion  
(Final)**

CONTRACT DATED:

PROJECT NAME: USM 25 BEDFORD STREET RENOVATION

SUSTANTIAL COMPLETION DATE:

FINAL COMPLETION is defined, in accordance with Article 9 of the General Conditions, as the date certified by the Architect when all the Work of the Project is fully complete, the Close-Out requirements of Paragraph 9.10 of the General Conditions have been completed, including the Close-Out Meeting and approval of Close-Out by the Architect, in accordance with Subparagraph 9.10.2, and the Contract fully performed in accordance with the Contract Documents, and the Contractor entitled to final payment.

The CONTRACTOR certifies that the Work is fully completed and was completed on or before \_\_\_\_\_, 20\_\_\_\_, and submits herewith:

- Application for Final Payment (AIA G702, or equal)
- Affidavit of Payments (AIA G706, or equal)
- Consent of Surety (AIA G707, or equal)
- Release of Liens (AIA G706A, or equal)
- Waiver of Lien

CONTRACTOR:

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

The Architect has inspected the Work and has determined that the Date of Final Completion was \_\_\_\_\_, 20\_\_\_\_.

ARCHITECT:

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

The OWNER hereby accepts the Work as fully complete and will make final payment.

By: \_\_\_\_\_  
 Robert W. Bertram  
 Executive Director of Facilities Management  
 University of Maine , University of Southern  
 Maine  
 Date: \_\_\_\_\_



# AIA<sup>®</sup> Document G706<sup>™</sup> – 1994

## Contractor's Affidavit of Payment of Debts and Claims

<b>PROJECT:</b> <i>(Name and address)</i> University of Maine System Project	<b>ARCHITECT'S PROJECT NUMBER:</b>	OWNER: <input type="checkbox"/>
<b>TO OWNER:</b> <i>(Name and address)</i>	<b>CONTRACT FOR:</b> General Construction	ARCHITECT: <input type="checkbox"/>
	<b>CONTRACT DATED:</b>	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

**STATE OF:**  
**COUNTY OF:**

The undersigned hereby certifies that, except as listed below, payment has been made in full and all obligations have otherwise been satisfied for all materials and equipment furnished, for all work, labor, and services performed, and for all known indebtedness and claims against the Contractor for damages arising in any manner in connection with the performance of the Contract referenced above for which the Owner or Owner's property might in any way be held responsible or encumbered.

**EXCEPTIONS:**

**SUPPORTING DOCUMENTS ATTACHED HERETO:**

- Consent of Surety to Final Payment. Whenever Surety is involved, Consent of Surety is required. AIA Document G707, Consent of Surety, may be used for this purpose

Indicate Attachment  Yes  No

**CONTRACTOR:** *(Name and address)*

BY: \_\_\_\_\_  
*(Signature of authorized representative)*

\_\_\_\_\_  
*(Printed name and title)*

*The following supporting documents should be attached hereto if required by the Owner:*

- Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
- Contractor's Affidavit of Release of Liens (AIA Document G706A).

Subscribed and sworn to before me on this date:

Notary Public:  
My Commission Expires:

 **AIA**® Document G706A™ – 1994

**Contractor's Affidavit of Release of Liens**

<b>PROJECT:</b> <i>(Name and address)</i> University of Maine System Project2	<b>ARCHITECT'S PROJECT NUMBER:</b>	OWNER: <input type="checkbox"/>
	<b>CONTRACT FOR:</b> General Construction	ARCHITECT: <input type="checkbox"/>
<b>TO OWNER:</b> <i>(Name and address)</i> University of Maine System 16 Central Street Bangor, ME 04401-5106	<b>CONTRACT DATED:</b>	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

**STATE OF:** Maine  
**COUNTY OF:**

The undersigned hereby certifies that to the best of the undersigned's knowledge, information and belief, except as listed below, the Releases or Waivers of Lien attached hereto include the Contractor, all Subcontractors, all suppliers of materials and equipment, and all performers of Work, labor or services who have or may have liens or encumbrances or the right to assert liens or encumbrances against any property of the Owner arising in any manner out of the performance of the Contract referenced above.

**EXCEPTIONS:**

**SUPPORTING DOCUMENTS ATTACHED HERETO:**

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

**CONTRACTOR:** *(Name and address)*

BY:

\_\_\_\_\_  
*(Signature of authorized representative)*

\_\_\_\_\_  
*(Printed name and title)*

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

**WAIVER OF LIEN**

**Date:**  
**State of Maine**  
**County of**

**TO:** Office of Facilities  
University of Maine System  
16 Central Street  
Bangor, ME 04401

**SUBJECT** University of Southern Maine  
Project Name USM 25 Bedford Street Renovation  
Project Location Portland, ME

Upon receipt of the sum of \_\_\_\_\_ (being the balance due us under the existing contract or subcontract agreement for work on the Subject Project) the undersigned agrees that it will waive and release the University of Maine System from any and all lien or claim or right to lien on the Subject Project under the Statutes of the State of Maine relating to liens for labor, materials and/or subcontracts furnished for the Subject Project on premises belonging to the University of Maine System.

Signed: \_\_\_\_\_  
Authorized Signature

Title \_\_\_\_\_

Firm Name: \_\_\_\_\_

**NOTARY**

Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_\_.

\_\_\_\_\_  
Signature Notary Public

# AIA<sup>®</sup> Document G707<sup>™</sup> – 1994

## Consent Of Surety to Final Payment

**PROJECT:** *(Name and address)*  
University of Maine System Project

**ARCHITECT'S PROJECT NUMBER:**

OWNER:

**CONTRACT FOR:**

ARCHITECT:

**TO OWNER:** *(Name and address)*  
University of Maine System  
16 Central Street  
Bangor, ME 04401-5106

**CONTRACT DATED:**

CONTRACTOR:

SURETY:

OTHER:

In accordance with the provisions of the Contract between the Owner and the Contractor as indicated above, the  
*(Insert name and address of Surety)*

on bond of  
*(Insert name and address of Contractor)*

, SURETY,

hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety  
of any of its obligations to  
*(Insert name and address of Owner)*

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

IN WITNESS WHEREOF, the Surety has hereunto set its hand on this date:  
*(Insert in writing the month followed by the numeric date and year.)*

\_\_\_\_\_  
*(Surety)*

\_\_\_\_\_  
*(Signature of authorized representative)*

Attest:  
*(Seal):*

\_\_\_\_\_  
*(Printed name and title)*



# AIA<sup>®</sup> Document A201<sup>™</sup> – 2007

## General Conditions of the Contract for Construction

### for the following PROJECT:

*(Name and location or address)*

University of Maine System Project

### THE OWNER:

*(Name, legal status and address)*

University of Maine System  
16 Central Street  
Bangor, ME 04401-5106

### THE ARCHITECT:

*(Name, legal status and address)*

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### ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

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**ARTICLE 1 GENERAL PROVISIONS****§ 1.1 BASIC DEFINITIONS****§ 1.1.1 THE CONTRACT DOCUMENTS**

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding requirements.

**§ 1.1.2 THE CONTRACT**

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

**§ 1.1.3 THE WORK**

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

**§ 1.1.4 THE PROJECT**

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

**§ 1.1.5 THE DRAWINGS**

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.

**§ 1.1.6 THE SPECIFICATIONS**

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

**§ 1.1.7 INSTRUMENTS OF SERVICE**

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

**§ 1.1.8 INITIAL DECISION MAKER**

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

**§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS**

**§ 1.2.1** The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

### § 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

### § 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

### § 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

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

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

### § 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

## ARTICLE 2 OWNER

### § 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

### § 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Prior to commencement of the Work, the Contractor may request in writing that the Owner provide reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. Thereafter, the Contractor may only request such evidence if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) a change in the Work materially changes the Contract Sum; or (3) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due. The Owner shall furnish such evidence as a condition precedent to commencement or continuation of the Work or the

portion of the Work affected by a material change. After the Owner furnishes the evidence, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.2 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

### § 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

### § 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner 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 Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

## ARTICLE 3 CONTRACTOR

### § 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.



### § 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

### § 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Architect and shall not proceed with that portion of the Work without further written instructions from the Architect. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

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

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

### § 3.4 LABOR AND MATERIALS

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

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§ 3.4.2 Except in the case of minor changes in the Work authorized by the Architect in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

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

### § 3.5 WARRANTY

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

### § 3.6 TAXES

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

### § 3.7 PERMITS, FEES, NOTICES, AND COMPLIANCE WITH LAWS

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

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 **Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 21 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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### § 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

### § 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the name and qualifications of a proposed superintendent. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to the proposed superintendent or (2) that the Architect requires additional time to review. Failure of the Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

### § 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall prepare and submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work.

§ 3.10.2 The Contractor shall prepare a submittal schedule, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Architect's approval. The Architect's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

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

### § 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Architect and shall be delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

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**§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

**§ 3.12.1** Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

**§ 3.12.2** Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

**§ 3.12.3** Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

**§ 3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

**§ 3.12.5** The Contractor shall review for compliance with the Contract Documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

**§ 3.12.6** By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**§ 3.12.7** The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect.

**§ 3.12.8** The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

**§ 3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such written notice, the Architect's approval of a resubmission shall not apply to such revisions.

**§ 3.12.10** The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy, accuracy and

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completeness of the services, certifications and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review, approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

### § 3.13 USE OF SITE

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

### § 3.14 CUTTING AND PATCHING

§ 3.14.1 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.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

### § 3.15 CLEANING UP

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

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

### § 3.16 ACCESS TO WORK

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

### § 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

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

### § 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 3.18.

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§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

#### ARTICLE 4 ARCHITECT

##### § 4.1 GENERAL

§ 4.1.1 The Owner shall retain an architect lawfully licensed to practice architecture or an entity lawfully practicing architecture in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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

§ 4.1.3 If the employment of the Architect is terminated, the Owner shall employ a successor architect as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

##### § 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate For Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

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

##### § 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Architect about matters arising out of or relating to the Contract. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Architect 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 to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

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

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

## ARTICLE 5 SUBCONTRACTORS

### § 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

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## § 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect may reply within 14 days to the Contractor in writing stating (1) whether the Owner or the Architect has reasonable objection to any such proposed person or entity or (2) that the Architect requires additional time for review. Failure of the Owner or Architect to reply within the 14 day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Architect makes reasonable objection to such substitution.

## § 5.3 SUBCONTRACTUAL RELATIONS

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

## § 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the

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Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

## **ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS**

### **§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS**

**§ 6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation. If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided in Article 15.

**§ 6.1.2** When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

**§ 6.1.3** The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

**§ 6.1.4** Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

### **§ 6.2 MUTUAL RESPONSIBILITY**

**§ 6.2.1** The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

**§ 6.2.2** If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Architect apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

**§ 6.2.3** The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

**§ 6.2.4** The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

**§ 6.2.5** The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

### **§ 6.3 OWNER'S RIGHT TO CLEAN UP**

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

**ARTICLE 7 CHANGES IN THE WORK****§ 7.1 GENERAL**

**§ 7.1.1** Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

**§ 7.1.2** A Change Order shall be based upon agreement among the Owner, Contractor and Architect; a Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect alone.

**§ 7.1.3** Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

**§ 7.2 CHANGE ORDERS**

**§ 7.2.1** A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor and Architect stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

**§ 7.3 CONSTRUCTION CHANGE DIRECTIVES**

**§ 7.3.1** A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, 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 being adjusted accordingly.

**§ 7.3.2** A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

**§ 7.3.3** If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

**§ 7.3.4** If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed in a proposed Change Order or Construction Change Directive so that application of such unit prices to quantities of Work proposed will cause substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

**§ 7.3.5** Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

**§ 7.3.6** A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

**§ 7.3.7** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount

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for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 Costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 Additional costs of supervision and field office personnel directly attributable to the change.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

#### § 7.4 MINOR CHANGES IN THE WORK

The Architect has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be effected by written order signed by the Architect and shall be binding on the Owner and Contractor.

### ARTICLE 8 TIME

#### § 8.1 DEFINITIONS

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

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

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

#### § 8.2 PROGRESS AND COMPLETION

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

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§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

### § 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control; or by delay authorized by the Owner pending mediation and arbitration; or by other causes that the Architect determines may justify delay, then the Contract Time shall be extended by Change Order for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

## ARTICLE 9 PAYMENTS AND COMPLETION

### § 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

### § 9.2 SCHEDULE OF VALUES

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit to the Architect, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment.

### § 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2., for completed portions of the Work. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

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

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encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work.

#### § 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Architect determines is properly due, or notify the Contractor and Owner in writing of the Architect's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

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

#### § 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

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

§ 9.5.3 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner 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. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Architect will reflect such payment on the next Certificate for Payment.

#### § 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

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

§ 9.6.3 The Architect 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 Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner 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 Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. Neither the Owner 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.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

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

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

#### § 9.7 FAILURE OF PAYMENT

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' written notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, plus interest as provided for in the Contract Documents.

#### § 9.8 SUBSTANTIAL COMPLETION

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

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

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

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§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

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

#### § 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

#### § 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) 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 Owner, (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 Owner, 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 Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

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

- .1 liens, Claims, security interests or encumbrances arising out of the Contract and unsettled;
- .2 failure of the Work to comply with the requirements of the Contract Documents; or
- .3 terms of special warranties required by the Contract Documents.

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

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### § 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

### § 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to

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

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Architect 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 the Contractor's obligations under Section 3.18.

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§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's 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 Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

**§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY**

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

**§ 10.3 HAZARDOUS MATERIALS**

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

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**§ 10.4 EMERGENCIES**

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

**ARTICLE 11 INSURANCE AND BONDS****§ 11.1 CONTRACTOR'S LIABILITY INSURANCE**

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to the Owner. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the Architect and the Architect's Consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

**§ 11.2 OWNER'S LIABILITY INSURANCE**

The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance.

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### § 11.3 PROPERTY INSURANCE

§ 11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the Contractor, Subcontractors and Sub-subcontractors in the Project.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance that will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor in writing, then the Owner shall bear all reasonable costs properly attributable thereto.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

### § 11.3.2 BOILER AND MACHINERY INSURANCE

The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

### § 11.3.3 LOSS OF USE INSURANCE

The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

§ 11.3.4 If the Contractor requests in writing that insurance for risks other than those described herein or other special causes of loss be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost thereof shall be charged to the Contractor by appropriate Change Order.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment

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property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 days' prior written notice has been given to the Contractor.

#### § 11.3.7 WAIVERS OF SUBROGATION

The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under the Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement. If the Owner and Contractor have selected arbitration as the method of binding dispute resolution, the Owner as fiduciary shall make settlement with insurers or, in the case of a dispute over distribution of insurance proceeds, in accordance with the directions of the arbitrators.

#### § 11.4 PERFORMANCE BOND AND PAYMENT BOND

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

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

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**ARTICLE 12 UNCOVERING AND CORRECTION OF WORK****§ 12.1 UNCOVERING OF WORK**

**§ 12.1.1** If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

**§ 12.1.2** If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

**§ 12.2 CORRECTION OF WORK****§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION**

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

**§ 12.2.2 AFTER SUBSTANTIAL COMPLETION**

**§ 12.2.2.1** In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.4.

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

**§ 12.2.2.3** The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

**§ 12.2.3** The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

**§ 12.2.4** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

**§ 12.2.5** Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

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**§ 12.3 ACCEPTANCE OF NONCONFORMING WORK**

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

**ARTICLE 13 MISCELLANEOUS PROVISIONS****§ 13.1 GOVERNING LAW**

The Contract shall be governed by the law of the place where the Project is located except that, if the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

**§ 13.2 SUCCESSORS AND ASSIGNS**

**§ 13.2.1** The Owner and Contractor respectively bind themselves, their partners, successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

**§ 13.2.2** The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate such assignment.

**§ 13.3 WRITTEN NOTICE**

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice.

**§ 13.4 RIGHTS AND REMEDIES**

**§ 13.4.1** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

**§ 13.4.2** No action or failure to act by the Owner, Architect or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

**§ 13.5 TESTS AND INSPECTIONS**

**§ 13.5.1** Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

**§ 13.5.2** If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

**§ 13.5.3** If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by

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such failure including those of repeated procedures and compensation for the Architect's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.5.5 If the Architect is to observe tests, inspections or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

#### § 13.6 INTEREST

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at such rate as the parties may agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

#### § 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

### ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

#### § 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- .4 The Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Section 2.2.1.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, repeated suspensions, delays or interruptions of the entire Work by the Owner as described in Section 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, including reasonable overhead and profit, costs incurred by reason of such termination, and damages.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

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**§ 14.2 TERMINATION BY THE OWNER FOR CAUSE****§ 14.2.1** The Owner may terminate the Contract if the Contractor

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

**§ 14.2.2** When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

**§ 14.2.3** When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

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

**§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE**

**§ 14.3.1** The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

**§ 14.3.2** The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay or interruption as described in Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was or would have been so suspended, delayed or interrupted by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

**§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE**

**§ 14.4.1** The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

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

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination, along with reasonable overhead and profit on the Work not executed.

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**ARTICLE 15 CLAIMS AND DISPUTES****§ 15.1 CLAIMS****§ 15.1.1 DEFINITION**

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

**§ 15.1.2 NOTICE OF CLAIMS**

Claims by either the Owner or Contractor must be initiated by written notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party must be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

**§ 15.1.3 CONTINUING CONTRACT PERFORMANCE**

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Architect will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

**§ 15.1.4 CLAIMS FOR ADDITIONAL COST**

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

**§ 15.1.5 CLAIMS FOR ADDITIONAL TIME**

**§ 15.1.5.1** If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

**§ 15.1.5.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

**§ 15.1.6 CLAIMS FOR CONSEQUENTIAL DAMAGES**

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

**§ 15.2 INITIAL DECISION**

**§ 15.2.1** Claims, excluding those arising under Sections 10.3, 10.4, 11.3.9, and 11.3.10, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim arising prior to the date final payment is due, unless 30 days have passed after the Claim has been referred to the Initial Decision Maker with no decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

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§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of such request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of an initial decision, demand in writing that the other party file for mediation within 60 days of the initial decision. If such a demand is made and the party receiving the demand fails to file for mediation within the time required, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

### § 15.3 MEDIATION

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.6 shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

#### § 15.4 ARBITRATION

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

#### § 15.4.4 CONSOLIDATION OR JOINDER

§ 15.4.4.1 Either party, at its sole discretion, may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Either party, at its sole discretion, may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as the Owner and Contractor under this Agreement.

**University of Maine System  
Supplementary Conditions  
to**

**AIA A201 2007 General Conditions of the Contract for Construction**

**§ 1.1.8** Add the following:

The Architect is the Initial Decision Maker for this Agreement.

**§1.2.2** Add the following:

Where the Procurement Requirements include provisions that portions of the Work be File Bid in accordance with the requirements of the Maine Bid Depository System, the subcontracts for these portions of the work will cover the same scope of work as defined by the Procurement Requirements and the File Bid and shall have the same contract amount as listed in the successful bid.

**§ 1.5.1** Add the following:

The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102 2007 and B201 2007 and the University of Maine Supplementary Requirements to those documents regarding the Instruments of Service.

**§ 1.5.2** Add the following:

The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102 2007 and B201 2007 and the University of Maine Supplementary Requirements to those documents regarding the Instruments of Service.

**§ 2.1.1.1** Insert the following:

**§ 2.1.1.1** For the purpose of this Contract, the Owner is defined as: University of Maine System; 16 Central Street; Bangor, Maine 04401 acting through its duly authorized agent.

**§2.2.1** Delete in its entirety

**§3.4.2.1** Insert the following:

**§ 3.4.2.1** After the Contract has been executed, the Owner and Architect may consider a formal request for substitution of products in place of those specified. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of the substitutions.

By making requests for substitutions, the Contractor:

- .1 Represents that the Contractor has personally investigated the proposed substitute product and determined it is equal or superior in all respects to that specified;
- .2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
- .3 Certifies that the cost data presented is complete and includes all related costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
- .4 Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.

**§3.4.4** Insert the following:

**§ 3.4.4** If a wage scale prepared by the State of Maine Department of Labor, Bureau of Labor Standards, is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor employed on the project.

The provisions of Title 26 MRSA Chapter 15 Preference to Maine Workers and Contractors, apply to this project, including but not limited to:

**§ 1310. Wage and benefits rates to be kept posted**

A clearly legible statement of all fair minimum wage and benefits rates to be paid the several classes of laborers, workers and mechanics employed on the construction on the public work must be kept posted in a prominent and easily accessible place at the site by each contractor and subcontractor subject to sections 1304 to 1313.

**§ 1311. Wage and benefit record of contractor**

The contractor and each subcontractor in charge of the construction of a public work shall keep an accurate record showing the names and occupation of all laborers, workers and mechanics employed by them and all independent contractors working under contract with them in connection with the construction on the public works. The record must also show for all laborers, workers, mechanics and independent contractors the hours worked, the title of the job, the hourly rate or other method of remuneration and the actual wages or other compensation paid to each of the laborers, workers, mechanics and independent contractors. A copy of such a record must be kept at the job site and must be open at all reasonable hours to the inspection of the Bureau of Labor Standards and the public authority that let the contract and its officers and agents. It is not necessary to preserve those records for a period longer

than 3 years after the termination of the contract. A copy of each such record must also be filed monthly with the public authority that let the contract. The filed record is a public record pursuant to Title 1, chapter 13, except that the public authority letting a contract shall adopt rules to protect the privacy of personal information contained in the records filed with the public authority under this section, such as Social Security numbers and taxpayer identification numbers. The rules may not prevent the disclosure of information regarding the classification of workers or independent contractors and the remuneration they receive. Such rules are routine technical rules as defined by Title 5, chapter 375, subchapter 2-A.

**§ 3.4.5** Insert the following:

**§ 3.4.5** If a wage scale prepared by the U.S. Department of Labor pursuant to the provision of the Davis-Bacon Act is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor on the project. The requirements and responsibilities within the Davis-Bacon Act apply to this project.

**§ 3.4.6** Insert the following:

**§ 3.4.6 EQUAL EMPLOYMENT OPPORTUNITY**

During the performance of this contract, the contractor agrees as follows:

**§ 3.4.6.1** The contractor will not discriminate against any employee or applicant for employment because of race, color, religious creed, sex, sexual orientation, national origin, ancestry, age, physical handicap or mental handicap. Such action shall include, but not be limited to, the following: employment, upgrading, demotions, transfers, recruitment or recruitment advertising; layoffs or terminations; rates of pay or other forms of compensation; and selection for training, including apprenticeship.

**§ 3.4.6.2** The contractor 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 race, color, religious creed, sex, sexual orientation national origin, ancestry, age, physical handicap or mental handicap.

**§ 3.4.6.3** The contractor will send to each labor union or representative of the workers with which there is a collective or bargaining agreement in place, or other contract or understanding, whereby labor is being furnished for the performances of his contract, a notice, as set forth in Attachment A attached hereto, to be provided by the contracting department or agency, advising the said labor union or workers' representative of the contractor's commitment under the provisions of the contract, and shall post copies of the notice in conspicuous places available to employees and to applicants for employment.

**§3.4.6.4** The contractor will cause the foregoing provisions to be inserted in all contracts for any work covered by this agreement so that such provisions will be binding upon each subcontractor.

**§ 3.4.6.5** Contractors and subcontractors with contracts in excess of \$50,000 will also pursue in good faith affirmative action programs.

§ 3.6.1 Insert the following:

§ 3.6.1 The University of Maine System is exempt from payment of taxes under the Maine Sales and Use Tax Law Title 36 Section 1760 for taxes on materials that are permanently incorporated into the real property belonging to the University of Maine System. The University of Maine System is also exempt from the payment of Federal Excise Taxes on articles not for resale and from the Federal Transportation Tax on all shipments; exemption certificates for these taxes will be furnished when required. All quotations shall be less these taxes. The contractor shall pay all other taxes that have been or are legally enacted.

§ 3.7.4 Replace the existing § 3.7.4 with the following:

**§ 3.7.4 Concealed or Unknown Conditions.** If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may proceed as provided in Article 15.

§3.10.1.1 Insert the following:

§ 3.10.1.1 The Contractor shall provide an updated Construction Schedule with each Application for Payment reflecting actual construction progress and activities.

§ 3.12.11 Insert the following:

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submission and two (2) resubmittals. The Architect's review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect for evaluation of such additional submittals.

§ 3.15.3 Insert the following:

**§ 3.15.3 Waste Management** The University is committed to a resource management strategy which reduces to a minimum the production of waste material

while reusing, recycling or composting as much as possible of the remaining materials. Contractor should strive to identify opportunities to reduce, reuse, or recycle waste from renovations or new construction, and will submit a construction waste management plan for the project.

**§ 4.1.1** Replace the existing § 4.1.1 with the following:

**§ 4.1.1** The Architect is a person or entity lawfully licensed to practice in the State of Maine. That person or entity is identified in the Agreement and is referred throughout the Contract Documents as if singular in number. Whenever the prime professional designer for the Work is an Engineer, the term Architect, wherever used in these documents shall have the term Engineer substituted for the term Architect. The Engineer shall be lawfully licensed to practice engineering in the State of Maine or an entity lawfully practicing engineering identified as such in the Agreement.

**§ 4.2.1** Replace the existing § 4.2.1 with the following:

**§ 4.2.1** The Architect will provide administration of the Contract as described in the Contract Documents, and will be an Owner's representative during construction until the date the final payment is due, and from time to time during the period for correction of Work described in § 12.2, and until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

**§ 4.2.2** Replace the existing § 4.2.2 with the following:

**§ 4.2.2** The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, endeavor to guard the Owner against defects and deficiencies in the Work, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

**§ 4.2.2.1** The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect as determined solely by the Owner, or request of the Contractor. The reimbursement shall be deducted from the next payment made from the Contract Sum following the Owner's payment to the Architect.

**§ 4.2.3** Delete the word "reasonably" from the first sentence.

**§ 4.2.10** Replace the existing § 4.2.10 with the following:



**§ 4.2.10** If the Owner and Architect agree, the Architect will provide one or more project representatives to assist in carrying out the Architect's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in the contract between the Architect, AIA B102 and B201-2007 and Supplemental Requirements to be incorporated in the Contract Documents and attached hereto as Exhibit A.

**§ 5.2.1** Add the following:

**§ 5.2.1.1** The Contractor shall provide Owner a list of all subcontractors and independent contractors on the job site and a record of the entity to whom that subcontractor or independent contractor is directly contracted and by whom that subcontractor or independent contractor is insured for workers' compensation purposes. The list shall be presented at the preconstruction meeting and, when changes occur, at each requisition meeting as necessary. Information from this list will be placed on Owner's web site and updated as needed as required by 26 MRSA §1302-A.

**§ 5.2.1.2** Where the use of the Maine Bid Depository was required by the Procurement Requirements, Subcontractors included in the Contractor's Proposal shall be the Subcontractors for the defined Work unless a change has been approved by the Owner.

**§ 7.1.4** Insert the following:

**§ 7.1.4** The combined overhead and profit included in the total cost to the Owner of a change in the Work shall be based on a previously agreed upon unit pricing or on the following schedule allowing for appropriate allowances for contract duration:

**.1** For the Contractor, for Work performed by the Contractor's own forces, 20% of the cost.

**.2** For the Contractor, for Work performed by the Contractor's Subcontractors, 10% of the amount due the Subcontractors.

**.3** For each Subcontractor involved, for Work performed by the Subcontractor's own forces, 20% of the cost.

**.4** For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 10% of the amount due the Sub-subcontractor.

**.5** Costs to which overhead and profit is to be applied shall be limited to the following:

**.1** Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;

**.2** Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;

**.3** Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

**.4** Costs of premiums for all bonds, insurance, permit fees, and sales, use or similar taxes related to the Work; and

**§ 7.1.5** When there is only an extension of Contract Time, the contractor delay claim is limited to additional costs related to supervision and field office personnel, which may be included in the overhead and profit calculation.

**§ 7.1.6** In order to facilitate checking of quotations, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they are to be itemized also. In no case will a change be approved without such itemization.

**§ 9.3.1** Add the following:

The forms for application of payment, duly notarized, shall be the current authorized edition of AIA Document G702, Application for Payment, supported by a current authorized edition of AIA G703, Continuation Sheet.

**§ 9.3.1.3** Insert the following:

**§ 9.3.1.3** The provisions of Title 5 M.R.S.A § 1746, as amended, pertain to this project. The University shall retain five percent (5%) of each payment due the Contractor as part of the security for the fulfillment of the Contract Agreement by the Contractor, the Contractor shall not withhold a greater percentage from subcontractors. The University may, if deemed expedient by the University, cause the Contractor to be paid temporarily or permanently from time to time during the progress of the work, such portion of the amount retained as the University deems prudent or desirable.

**§ 9.5.1** The word “shall” will be substituted for the word “may” in all places in § 9.5.1.

**§ 9.5.1.1** Replace with the following:

**§ 9.5.1.1** Defective Work, i.e. Work that does not conform to the requirements of the contract, shall include, but not be limited to, non-conforming Work, disputed Work, incomplete Work, and unacceptable Work, which is not remedied.

**§ 9.5.1.1.1** The Architect shall deduct and withhold from any certification for payment an amount equal to one hundred and fifty percent (150%) the value of any defective Work.

**§ 9.6.8** Insert the following:

**§ 9.6.8** All Progress Payments and Final Payment are subject to the requirements of

the "Maine Prompt Pay Act" Title 10 M.R.S.A. § 201-A, as amended. Payments shall be made on a timely basis in accord with the requirements of this Statute; however, the Contractor waives interest on any late payment.

**§ 9.10.1.1** Insert the following:

**§ 9.10.1.1** Except with the consent of the Owner, the Architect will perform no more than three (3) site reviews to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional site reviews.

**§ 9.11** Insert the following:

**§ 9.11** The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the sums stipulated as liquidated damages in the Contract Documents for each calendar day of delay after the date established for Substantial Completion in the Contract Documents until the Work is substantially complete.

**§10.2.1** Add the following:

**.4** If this Contract involves renovation, repair, or preparation of surfaces for painting in pre-1978 apartments, houses, or spaces used by child care facilities, Contractor shall use certified workers who follow the lead-safe work practices as required by the US Environmental Protection Agency's Renovation, Repair and Remolding rule described in 40 CFR § 745.85. Notification of the tenants or users under this rule will be the responsibility of the University.

**§ 10.3.2** Replace the existing §10.3.2 with the following:

**§ 10.3.2** Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor.

**§ 11.1.3** Add the following:

Certificates of Insurance filed with the University of Maine System shall indicate the Certificate Holder as University of Maine System, 16 Central Street, Bangor, Maine 04401. The Project name, campus, and general liability insurance required policy form and two required endorsements noted in Paragraph 11.1.5.1 below shall be included on the Certificate. Contractor must provide renewal certificates at least 15 days prior to expiration.

**§ 11.1.4** Add the following:

Neither the Contractor nor any Subcontractors or Suppliers shall commence work at

the project site under this contract until the Contractor has provided the University with a standard ACORD certificate with an attached AIA Document G715-1991 listing all insurance coverages and limits required under this section. All required insurance shall be maintained throughout the term of this contract (including correction period, defined in 12.2.2.1) and be on a primary basis, noncontributory with any other insurance carried by the University. All required insurance shall be provided by companies that have a current A.M. Best insurance rating of A- or better and that are licensed or approved to do business in the State of Maine.

**§ 11.1.5** Insert the following:

**§ 11.1.5 COVERAGE LIMITS** - The required insurance and coverage limits are as follows:

**§ 11.1.5.1 General Liability** -Contractor shall provide General Liability insurance with coverage for premises and operations, products and completed operations, explosion, collapse and underground hazards, broad form property damage, contractual, personal and advertising injury liabilities. Insurance shall be provided on a standard Insurance Services Office (ISO) Commercial General Liability Form CG 00 01 12 04 or equivalent and shall include the following three endorsements or their equivalent: 1) Additional Insured—Owners, Lessees or Contractors—Scheduled Person or Organization (CG20 10 07 04) with the University of Maine System, 16 Central Street, Bangor, ME 04401 listed as additional insured; 2) Additional Insured—Owners, Lessees or Contractors—Completed Operations (CG 20 37 07 04) with the University of Maine System, 16 Central Street, Bangor, ME 04401 listed as additional insured; and 3) Designated Construction Project General Aggregate Limit (CG 25 03 03 97) ) as the Aggregate limits shall apply on a per location or job basis. The policy form and endorsements must be included on the certificate of insurance. The below required minimum insurance limits shall not be construed as a limitation of the University's rights under any insurance with higher limits and no insurance shall be endorsed to include such a limitation. General Liability insurance required minimum limits:

.1 General Aggregate	\$2,000,000
.2 Products & Completed Operations Aggregate	\$2,000,000
.3 Personal Injury Aggregate	\$1,000,000
.4 Each Occurrence for Contracts Under \$1 million	\$1,000,000
.5 Each Occurrence for Contracts \$1 million and above	\$2,000,000
.6 Personal/Advertising Injury	\$1,000,000
.7 Medical Payments (Any One Person)	\$5,000

**§ 11.1.5.2 Workers' Compensation** - Contractor including Independent Contractors shall provide Worker's Compensation insurance with coverage on a statutory basis according to Maine Law and apply to all personnel on the job site. Workers' Compensation insurance required minimum limits:

- |                                       |                  |
|---------------------------------------|------------------|
| .1 Coverage A (Workers' Compensation) | Statutory Limits |
| .2 Coverage B (Employers Liability)   |                  |

- |                              |                         |
|------------------------------|-------------------------|
| .1 Bodily injury by accident | \$500,000 each accident |
| .2 Bodily injury by disease  | \$500,000 each employee |
| .3 Bodily injury by disease  | \$500,000 policy limit  |

**§ 11.1.5.3** Vehicle Liability Insurance - Contractor shall provide Vehicle Liability insurance with coverage for all owned, hired/rented and non-owned vehicles. Vehicle Liability insurance required minimum limit:

- |                          |  |
|--------------------------|--|
| .1 Combined Single Limit | \$1,000,000 each accident                                |
|                          | or   |
| .2 Split Limits          | \$1,000,000 bodily injury<br>\$1,000,000 property damage |

**§ 11.3.1** Replace all of the existing § 11.3.1 and its subparagraphs with the following:

**[NOTE: THE PROJECT MANAGER WILL MANUALLY DELETE FROM THIS SECTION THE ONE NOT SELECTED TO DESCRIBE THE TYPE OF PROJECT.]**

**[FOR NEW, STAND-ALONE CONSTRUCTION AND MAJOR ADDITIONS USE THIS PARAGRAPH. Use for stand-alone buildings and major additions with fire walls and fire doors separating the addition from the existing building:]**

**§ 11.3.1** The Contractor shall secure "All Risk" type Builder's Risk Insurance, appropriate for the Project, with an insurance company lawfully authorized to do business in the State of Maine, and shall maintain said insurance during the contract time. The insurance shall be written on a replacement cost basis and the amount of the insurance shall not be less than the full replacement cost of the Project and Project materials. The insurance shall cover, at a minimum, losses due to fire, smoke, explosion, hail, lightning, theft, vandalism, malicious mischief, wind, collapse, riot, aircraft, and increased cost of construction. Insurance shall also cover portions of the work located away from the site but intended for use at the site, and for portions of the work in transit. In the event of a loss, the insurance deductible and any uncovered loss will be assumed by the Contractor. The insurance shall name as the insured the Contractor, the Subcontractors, the Designer, and the University. The policy must be written as the primary insurance covering the project and include endorsement providing permission to occupy in advance of project completion. A certificate of insurance verifying coverage shall be forwarded simultaneously to the Designer and the University prior to starting any work at the site. If the Contractor fails to maintain the appropriate insurance, then the Contractor shall bear all reasonable costs attributed to that failure.

**[FOR RENOVATION, ALTERATION AND/OR ADDITION WORK USE THIS PARAGRAPH:]**

**§ 11.3.1** For this project, Property Insurance coverage, up to the total amount of the Project, will be provided by the University by adding the Project to the University's existing master property insurance. Coverage shall be included for the Contractor and all Subcontractors, as their interests may appear, while involved in the Project and

until the work is completed or the contractor is otherwise advised in writing. This insurance is limited to the "all risk" type coverage provided under the University's master property insurance for direct physical loss or damage to the building or building materials related to the project, subject to standard policy limitations and exclusions. The contractor is responsible for a \$10,000 per claim deductible. Any other insurance desired by the Contractor beyond that covered by the University's insurance, or to cover the \$10,000 deductible, is the responsibility of the Contractor. This contract stands as verification of the University's property insurance coverage on the project and no further verification will be provided.

**§ 11.4.1** Replace the existing §11.4.1 with the following:

**§ 11.4.1** The Contractor shall furnish a Performance Bond and a Payment Bond covering the faithful performance of the contract and payment of obligations arising thereof. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100% of the Contract Sum. Should the Contract Sum change during the contract and warranty periods, the amount of the Bonds will be changed to reflect the Contract Sum.

**§ 11.4.1.1** The Contractor shall deliver the required bonds to the Owner at the same time as the signed Contract Agreement is delivered to the Owner. Prior to the commencement of the Work, the Contractor shall submit satisfactory evidence that such bonds will be furnished.

**§ 11.4.1.2** The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

**§ 11.4.1.3** The Contract Bonds shall continue in effect for one year after final acceptance of each contract to protect the Owner's interest in connection with the one year guarantee of workmanship and materials and to assure settlement of claims, for the payment of all bills for labor, materials, and equipment by the Contractor.

**§ 13.6** Delete §13.6 in its entirety.

**§ 14.1.1.4** Delete §14.1.1.4 in its entirety.

**§ 14.1.3** Delete the words "and damages"

**§ 14.4.3** Replace the existing §14.4.3 with the following:

**§ 14.4.3** In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for the work executed and costs incurred by reason of such termination, but not overhead and profit on Work not executed.

**§ 15.4.1** Replace the existing §15.4.1 with the following:

**§ 15.4.1** The parties have selected arbitration as the method for binding dispute

resolution in this Agreement, any claim, dispute or other matter in question arising out of or related to this Agreement subject to, but not resolved by, mediation shall be subject to arbitration, which unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of this Agreement, except that the parties shall select only one Arbitrator, and there shall be no discovery. A demand for arbitration shall be made in writing, delivered to the other party to this Agreement, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be defended.

# THE MAINE HUMAN RIGHTS ACT GUARANTEES...

## Equal Employment Rights

### EQUAL EMPLOYMENT RIGHTS

1. The RIGHT to freedom from discrimination in employment.
2. The opportunity for an individual to secure employment without discrimination... is declared to be a CIVIL RIGHT.

The Maine Human Rights Act prohibits discrimination because of race, color, sex, sexual orientation, age, physical or mental disability, genetic pre-disposition, religion, ancestry or national origin.

The Maine Human Rights Act also prohibits discrimination because of filing a claim or asserting a right under the Worker's Comp Act or retaliation under the Whistleblower's Act.

### UNLAWFUL EMPLOYMENT DISCRIMINATION

1. For any employer to fail or refuse to hire an applicant
2. For any employer to discharge an employee
3. For any employer to discriminate against an employee with respect to recruitment, tenure, promotion, transfer, or compensation
4. For any employment agency to fail or refuse to classify properly or refer for employment an applicant
5. For any labor organization to exclude from apprenticeship or membership an applicant
6. For any employer, employment agency, or labor organization prior to employment or admission to membership of an individual to ask questions, keep as record, use application form, issue any notice, employ a quota system
7. For any employer, employment agency, or labor organization to retaliate against a person who has opposed a violation of the Maine Human Rights Act

Because of race, color, sex, sexual orientation, age, physical or mental disability, genetic pre-disposition, religion, ancestry or national origin or because of asserting a claim under the Worker's Comp Act or Whistleblower's Act.

## MAINE = HUMAN RIGHTS COMMISSION

IF YOU FEEL YOU HAVE BEEN DISCRIMINATED AGAINST, CONTACT THE COMMISSION OFFICE.  
51 STATE HOUSE STATION, AUGUSTA, MAINE 04333-0051  
PHONE (207) 624-6050 FAX (207) 624-6063 TTY 1-888-577-6690

(Rev. Dec. 28, 2005)

Printed under appropriation: 01094H1010012

Attachment A



State of Maine  
 Department of Labor  
 Bureau of Labor Standards  
 Technical Services Division  
 Augusta, Maine 04333-0045  
 Telephone (207) 623-7906

007346 - Wage Rates

Wage Determination - In accordance with 26 MRSA §1301 et. seq., this is a determination by the Bureau of Labor Standards, of the fair minimum wage rate to be paid laborers and workers employed on the below titled project.

Title of Project -----25 Bedford Street Renovation

Location of Project --Portland, Cumberland County

**2012 Fair Minimum Wage Rates  
 Building 2 Cumberland County  
 (other than 1 or 2 family homes)**

Occupation Title	Minimum Wage	Minimum Benefit	Total	Occupation Title	Minimum Wage	Minimum Benefit	Total
Asbestos/Lead Removal Worker	\$15.00	\$1.65	\$16.65	HVAC	\$23.00	\$3.89	\$26.89
Assembler - Metal Building	\$15.00	\$0.23	\$15.23	Insulation Installer	\$18.00	\$1.77	\$19.77
Backhoe Loader Operator	\$18.00	\$3.44	\$21.44	Ironworker - Reinforcing	\$17.00	\$0.00	\$17.00
Boom Truck (Truck Crane) Operator	\$25.00	\$14.23	\$39.23	Ironworker - Structural	\$20.87	\$6.61	\$27.48
Bricklayer	\$22.00	\$1.23	\$23.23	Laborers (Incl. Helpers & Tenders)	\$13.00	\$0.29	\$13.29
Bulldozer Operator	\$18.00	\$3.16	\$21.16	Laborer - Skilled	\$17.00	\$1.91	\$18.91
Carpenter	\$19.50	\$3.28	\$22.78	Loader Operator - Front-End	\$16.00	\$3.07	\$19.07
Carpenter - Acoustical	\$17.43	\$0.00	\$17.43	Mechanic, Maintenance	\$19.50	\$2.87	\$22.37
Carpenter - Rough	\$16.00	\$2.48	\$18.48	Mechanic, Refrigeration	\$22.00	\$3.54	\$25.54
Cement Mason/Finisher	\$19.50	\$0.00	\$19.50	Millwright	\$23.37	\$10.54	\$33.91
Communication Equip Installer	\$23.50	\$3.38	\$26.88	Oil/Fuel Burner Servicer & Installer (Licensed)	\$21.00	\$4.18	\$25.18
Concrete Mixing Plant Operator	\$17.50	\$5.79	\$23.29	Painter	\$15.16	\$0.30	\$15.46
Concrete Pump Operator	\$20.00	\$3.54	\$23.54	Pipe/Steam/Sprinkler Fitter	\$22.00	\$4.16	\$26.16
Crane Operator <15 Tons	\$18.50	\$2.41	\$20.91	Pipelayer	\$22.00	\$4.89	\$26.89
Crane Operator =>15 Tons)	\$22.03	\$7.65	\$29.68	Plumber (Licensed)	\$23.75	\$3.79	\$27.54
Crusher Plant Operator	\$15.50	\$3.52	\$19.02	Plumber Helper/Trainee (Licensed)	\$19.75	\$3.33	\$23.08
Diver	\$23.00	\$1.98	\$24.98	Propane & Natural Gas Servicer & Inst(Licensed)	\$21.00	\$2.73	\$23.73
Driller - Well	\$16.48	\$1.84	\$18.32	Pump Installer	\$17.00	\$2.26	\$19.26
Dry-Wall Applicator	\$19.50	\$1.14	\$20.64	Roofer	\$16.00	\$1.29	\$17.29
Dry-Wall Taper & Finisher	\$20.00	\$0.77	\$20.77	Sheet Metal Worker	\$18.00	\$3.34	\$21.34
Electrician - Licensed	\$23.10	\$4.51	\$27.61	Sider	\$15.00	\$0.93	\$15.93
Electrician Helper/Cable Puller (Licensed)	\$15.58	\$2.74	\$18.32	Stone Mason	\$14.00	\$0.00	\$14.00
Elevator Constructor/Installer	\$49.68	\$27.36	\$77.04	Tile Setter	\$21.50	\$4.93	\$26.43
Excavator Operator	\$21.25	\$2.99	\$24.24	Truck Driver - Light	\$15.25	\$2.02	\$17.27
Fence Setter	\$12.75	\$0.38	\$13.13	Truck Driver - Medium	\$14.95	\$1.08	\$16.03
Flagger	\$9.00	\$0.00	\$9.00	Truck Driver - Heavy	\$16.00	\$1.14	\$17.14
Floor Layer	\$18.38	\$2.94	\$21.32	Truck Driver - Tractor Trailer	\$15.50	\$3.71	\$19.21
Glazier	\$14.75	\$3.10	\$17.85	Truck Driver - Mixer (Cement)	\$17.25	\$5.03	\$22.28
Highway Worker/Guardrail Installer	\$13.75	\$1.60	\$15.35				

The Laborer classifications include a wide range of work duties. Therefore, if any specific occupation to be employed on this project is not listed in this determination, call the Bureau of Labor Standards at the above number for further clarification.


Welders are classified in the trade to which the welding is incidental.

Apprentices - The minimum wage rate for registered apprentices are those set forth in the standards and policies of the Maine State Apprenticeship and Training Council for approved apprenticeship programs.

Posting of Schedule - Posting of this schedule is required in accordance with 26 MRSA §1301 et. seq., by any contractor holding a State contract for construction valued at \$50,000 or more and any subcontractors to such a contractor.

Appeal - Any person affected by the determination of these rates may appeal to the Commissioner of Labor by filing a written notice with the Commissioner stating the specific grounds of the objection within ten (10) days from the filing of these rates with the Secretary of State.

Determination No: B2-023-2012  
 Filing Date: February 23, 2012  
 Expiration Date: 12-31-2012

A true copy  
 Attest:   
 Richard V Snow  
 Director  
 Bureau of Labor Standards

## SECTION 011000 - SUMMARY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Work covered by the Contract Documents.
  - 2. Type of the Contract.
  - 3. Work schedule.
  - 4. Work under other contracts.
  - 5. Use of premises.
  - 6. Owner's occupancy requirements.
  - 7. Work restrictions.
  - 8. Specification formats and conventions.
- B. Related Sections include the following:
  - 1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

#### 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: University of Southern Maine, 25 Bedford Street Renovation.
  - 1. Project Location: Portland, Maine.
- B. Owner: University of Maine System.
- C. Architect: Harriman, Auburn Business Park, 46 Harriman Drive, Auburn, ME.

#### 1.4 TYPE OF CONTRACT

- A. Project will be constructed under a single prime contract.

#### 1.5 PERMITS

- A. The Contractor is responsible for electrical permit and plumbing permit. Contractor is responsible for obtaining the Certificate of Occupancy from authorities having jurisdiction.

#### 1.6 WORK SCHEDULE

- A. Substantial completion date for the work:
  - 1. The building and site shall be substantially complete on or before June 18, 2012
- B. Final completion, including completion of interior punch list items shall be done on or before July 03, 2012.

- C. Time: The term “day” as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

#### 1.7 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under separate contracts.

#### 1.8 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated and /or as specified. The Work includes providing support systems to receive Owner's equipment.
  1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
  2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
  3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
  4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
  5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
  6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
  7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
  8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
  9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
  10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
  11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.

#### 1.9 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations as indicated on Drawings by the Contract limits.
- B. Use of Site: Limit use of premises to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
  1. Owner Occupancy: Allow for Owner occupancy of rooms and facilities adjacent to the work and use by the public.
  2. Driveways and Entrances: Keep driveways, parking, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
    - a. Schedule deliveries to minimize use of driveways and entrances.
    - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

#### 1.10 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing building during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
  - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
  - 2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work.
  - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
  - 2. Contractor shall obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
  - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
  - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

#### 1.11 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7:00 a.m. to 5:00 p.m., Monday through Friday, except otherwise indicated.
  - 1. Early Morning Hours: Contractor allowed access to site during early morning hours (prior to 7:00 am) upon request and approval of the owner.
  - 2. Hours for Core Drilling and Concrete Saw Cutting: Work shall be performed during Early Morning Hours.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect and Owner not less than three days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's written permission.
  - 3. Shutdowns shall be scheduled during after hours, when the facility is not occupied.

## 1.12 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "2004 MasterFormat" numbering system.
  - 1. Section Identification: The Specifications use Section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.
  - 2. Division 1: Sections in Division 1 govern the execution of the Work of all Sections in the Specifications.
- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
  - 1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural, and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
  - 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text for clarity to describe responsibilities that must be fulfilled indirectly by Contractor or by others when so noted.
    - a. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

## 1.13 MISCELLANEOUS PROVISIONS

- A. Material safety data sheets shall be made available in accordance with OSHA requirements.
- B. No asbestos containing materials shall be used in the work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

## SECTION 012300 - ALTERNATES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. 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.
  - 2. Hold pricing for 30 days from date of bid to allow Owner time for project accounting. Alternates not accepted before contract signing may be added by Change Order later.

#### 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.
- 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. Schedule: A Schedule of Alternates is included at the end of this Section.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

Alternate No. 1- NOT USED

END OF SECTION 012300

## SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
  - 1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

#### 1.3 MINOR CHANGES IN THE WORK

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

#### 1.4 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
  - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
  - 2. Within 20 days after receipt of Proposal Request or earlier as specified in Proposal Request issued, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include costs of labor and supervision directly attributable to the change.
    - d. Include quotes on supplier's and subcontractor's letterhead for the requested change.
    - e. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float time before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.



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

C. Proposal Request Form: Use AIA Document G709 for Proposal Requests, or format as approved by the Owner.

## 1.5 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
1. Include installation costs in purchase amount only where indicated as part of the allowance.
  2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
  3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
  4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 21 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 21 days after such authorization.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
  2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

## 1.6 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a University of Maine Change Order form for signatures of Owner and Contractor.

## 1.7 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 . Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
  - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
  
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

## SECTION 012900 - PAYMENT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
  - 1. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
  - 2. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.

#### 1.3 DEFINITIONS

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

#### 1.4 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
    - a. Application for Payment forms with Continuation Sheets.
    - b. Submittals Schedule.
    - c. Contractor's Construction Schedule.
  - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
    - a. Submit Schedule of Values to the Architect in electronic format for review, comment and approval by the Owner.
  - 3. Subschedules: Where the Work is separated into phases requiring separately phased payments, provide subschedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
  - 1. Cover Sheet Identification: Include the following Project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of Architect.
    - c. Architect's project number.

- d. Contractor's name and address.
- e. Date of submittal.
- f. Certification that Record Drawings have been updated and verified.
2. Submit draft of Continuation Sheets.
3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
  - a. Related Specification Section or Division.
  - b. Description of the Work.
  - c. Name of subcontractor.
  - d. Name of manufacturer or fabricator.
  - e. Name of supplier.
  - f. Change Orders (numbers) that affect value.
  - g. Dollar value.
    - 1) Percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents, providing at least one line item for each Specification Section. Provide several line items for principal subcontract amounts, where appropriate.
  - a. For each line item, provide a sublist breakdown as follows:
    - 1) Material.
    - 2) Labor.
5. For Division 15 work, provide the following additional line item breakdown of the mechanical subcontractor's work for each Application for Payment.
  - a. Ductwork Systems.
  - b. HVAC Piping Systems.
  - c. HVAC Equipment.
  - d. HVAC Controls.
  - e. Plumbing, including fixtures and piping.
6. Documentation: Submit proper documentation for the amounts being requisitioned from subcontractors and material suppliers with each Application for Payment.
7. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
8. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
  - a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
  - b. Only major long lead delivery items may be considered for off-site storage (Example: Long lead custom mechanical unit). Standard order and production materials and products shall be delivered to the site before including in Application of Payment on such items.
9. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
10. Allowances: Provide a separate line item in the Schedule of Values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
11. Each item in the Schedule of Values and Applications for Payment shall be complete.
  - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at Contractor's option.

12. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.
- C. The Contractor shall furnish to the Architect at the beginning of the project an expected monthly requisition estimate for the Owner's use in planning funding.

#### 1.5 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: Progress Payment Applications shall be submitted to Architect not less than 7 days before monthly progress meeting. The period covered by each Application for Payment is one month, ending on the last day of the month.
1. Submit electronic copy to Architect and to Owner for review and comment at least 7 days before monthly progress meeting. Upon receipt of review comments, prepare notarized paper copies and transmit for signing at the progress meeting.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
  2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit 3 signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
  2. Submit one electronic copy of Application for Payment.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's liens from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
  2. When an application shows completion of an item, submit final or full waivers.
  3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
  4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

5. Waiver Forms: Submit waivers of lien on University of Maine System Wavier of Lien form, executed in a manner acceptable to Owner.
- G. Record Drawing Updates: With each Application of Payment, record documents shall be maintained and current for all trades, available for viewing at a central location.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
  2. Schedule of Values.
  3. Contractor's Construction Schedule (preliminary if not final).
  4. Products list.
  5. Schedule of unit prices.
  6. Submittals Schedule (preliminary if not final).
  7. List of Contractor's staff assignments.
  8. List of Contractor's principal consultants.
  9. Copies of building permits and other required permits.
  10. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
  11. Initial progress report.
  12. Report of preconstruction conference.
  13. Certificates of insurance and insurance policies.
  14. Performance and payment bonds.
- I. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of progress Applications for Payment include the following:
1. Contractor's Construction Schedule update.
  2. Submittals for Work being requisitioned for are complete and approved.
  3. Submit list of completed tests, checklists, commissioning, reports and similar requirements for the work are submitted and in compliance with the Contract Documents.
  4. Minutes of previous month's progress meeting have been distributed.
  5. Record drawings are current.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion less retainage, for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
  2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements, record documents, operation and maintenance data, and demonstration and training.
  2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
  3. Updated final statement, accounting for final changes to the Contract Sum.
  4. University of Maine System Waiver of Lien.
  5. AIA Document G707, "Consent of Surety to Final Payment."

6. Evidence that claims have been settled.
7. Final, liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

## SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
  - 1. Coordination Drawings.
  - 2. Administrative and supervisory personnel.
  - 3. Project meetings.
- B. Related Sections include the following:
  - 1. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
  - 2. Division 01 Section "Execution Requirements" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
  - 3. Division 01 Section "Closeout Procedures" for coordinating Contract closeout.

#### 1.3 COORDINATION

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
  - 1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
  - 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
  - 3. Make adequate provisions to accommodate items scheduled for later installation.
  - 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical. Coordinate location of pipes, conduits, ducts and similar items in confined areas to assure proper fit and access. Contractor is responsible for handling interferences created by the work of subcontractors (example, sprinkler pipe interfering with installation of duct work; duct work interfering with installation of tight fixtures).
- B. Coordinate with contractors doing work for the Owner under separate contracts.
- C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.



1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.
- D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
  2. Preparation of the Schedule of Values.
  3. Installation and removal of temporary facilities and controls.
  4. Delivery and processing of submittals.
  5. Progress meetings.
  6. Preinstallation conferences.
  7. Project closeout activities.
  8. Startup and adjustment of systems.
  9. Project closeout activities.
- E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

#### 1.4 SUBMITTALS

- A. Coordination Drawings: Prepare Coordination Drawings as determined by the Contractor and subcontractors, if limited space availability necessitates maximum utilization of space for efficient installation of different components or if coordination is required for installation of products and materials fabricated by separate entities.
1. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
    - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
    - b. Indicate required installation sequences.
    - c. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

## 1.5 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.
  - 1. Include special personnel required for coordination of operations with other contractors.

## 1.6 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
  - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
  - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
  - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.
  
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
  - 1. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
  - 2. Agenda: Discuss items of significance that could affect progress, including the following:
    - a. Tentative construction schedule.
    - b. Phasing.
    - c. Critical work sequencing and long-lead items.
    - d. Designation of key personnel and their duties.
    - e. Procedures for processing field decisions and Change Orders.
    - f. Procedures for requests for interpretations (RFIs).
    - g. Procedures for testing and inspecting.
    - h. Procedures for processing Applications for Payment.
    - i. Distribution of the Contract Documents.
    - j. Submittal procedures.
    - k. Preparation of Record Documents.
    - l. Use of the premises.
    - m. Work restrictions.
    - n. Owner's occupancy requirements.
    - o. Responsibility for temporary facilities and controls.
    - p. Construction waste management and recycling.
    - q. Parking availability.
    - r. Office, work, and storage areas.
    - s. Equipment deliveries and priorities.
    - t. First aid.
    - u. Security.

- v. Progress cleaning.
  - w. Working hours.
  - x. USM campus operational protocols and procedures.
3. Minutes: Record and distribute meeting minutes.
    - a. Include action items and responsible party.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
  2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
    - a. The Contract Documents.
    - b. Options.
    - c. Related requests for interpretations (RFIs).
    - d. Related Change Orders.
    - e. Purchases.
    - f. Deliveries.
    - g. Submittals.
    - h. Review of mockups.
    - i. Possible conflicts.
    - j. Compatibility problems.
    - k. Time schedules.
    - l. Weather limitations.
    - m. Manufacturer's written recommendations.
    - n. Warranty requirements.
    - o. Compatibility of materials.
    - p. Acceptability of substrates.
    - q. Temporary facilities and controls.
    - r. Space and access limitations.
    - s. Regulations of authorities having jurisdiction.
    - t. Testing and inspecting requirements.
    - u. Installation procedures.
    - v. Coordination with other work.
    - w. Required performance results.
    - x. Protection of adjacent work.
    - y. Protection of construction and personnel.
    - z. Record drawing process.
  3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
    - a. Include action items and responsible party.
  4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Monthly Progress Meetings: Conduct progress meetings at monthly intervals. Coordinate dates of meetings with preparation of payment requests.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
  - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - 1) Review schedule for next period.
  - b. Application for Payment: Contractor shall bring copy of Application for Payment to meeting. Review Application for Payment and required attachments, record drawing and documents status, waivers of mechanic's liens, list of completed tests, checklists, commissioning, reports, and similar requirements for the work are submitted and in compliance with the Contract Documents.
  - c. Review present and future needs of each entity present, including the following:
    - 1) Interface requirements.
    - 2) Sequence of operations.
    - 3) Status of submittals.
    - 4) Deliveries.
    - 5) Off-site fabrication.
    - 6) Access.
    - 7) Site utilization.
    - 8) Temporary facilities and controls.
    - 9) Work hours.
    - 10) Hazards and risks.
    - 11) Progress cleaning.
    - 12) Quality and work standards.
    - 13) Status of correction of deficient items.
    - 14) Field observations.
    - 15) Requests for interpretations (RFIs).
    - 16) Status of proposal requests.
    - 17) Pending changes.
    - 18) Status of Change Orders.
    - 19) Pending claims and disputes.
    - 20) Documentation of information for payment requests.
3. Minutes: Record and distribute the meeting minutes.
  - a. Include action items and responsible party.
4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
  - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

- E. Coordination/Progress Meetings: Conduct Project coordination/progress meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Attendees: In addition to representatives of Owner, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work
  2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
    - a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to Combined Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
    - b. Schedule Updating: Revise Combined Contractor's Construction Schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
    - c. Review present and future needs of each contractor present, including the following:
      - 1) Interface requirements.
      - 2) Sequence of operations.
      - 3) Status of submittals.
      - 4) Deliveries.
      - 5) Off-site fabrication.
      - 6) Access.
      - 7) Site utilization.
      - 8) Temporary facilities and controls.
      - 9) Work hours.
      - 10) Hazards and risks.
      - 11) Progress cleaning.
      - 12) Quality and work standards.
      - 13) Change Orders.
  3. Conduct coordination meetings with the mechanical, plumbing, sprinkler and electrical trades. Before the trades start work in an area of the building, review structural clearances and locations of ducts, pipes, conduits, light fixtures, equipment and other items that affect location and proper fit. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components. Verify depths and clearances before fabrication of ductwork.
  4. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.
    - a. Include action items and responsible party.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

## SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Preliminary Construction Schedule.
  - 2. Contractor's Construction Schedule.
  - 3. Submittals Schedule.
  - 4. Field condition reports.
  - 5. Special reports.
- B. Related Sections include the following:
  - 1. Division 1 Section "Payment Procedures" for submitting the Schedule of Values.
  - 2. Division 1 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
  - 3. Division 1 Section "Submittal Procedures" for submitting schedules and reports.
  - 4. Division 1 Section "Quality Requirements" for submitting a schedule of tests and inspections.

#### 1.3 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  - 2. Predecessor Activity: An activity that precedes another activity in the network.
  - 3. Successor Activity: An activity that follows another activity in the network.
- B. Cost Loading: The allocation of the Schedule of Values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum, unless otherwise approved by Architect.
- C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- E. Event: The starting or ending point of an activity.

- F. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
  - 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- G. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- H. Major Area: A story of construction, a separate building, or a similar significant construction element.
- I. Milestone: A key or critical point in time for reference or measurement.
- J. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.
- K. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

#### 1.4 SUBMITTALS

- A. Submittals Schedule: Submit three copies of schedule. Arrange the following information in a tabular format:
  - 1. Scheduled date for first submittal.
  - 2. Specification Section number and title.
  - 3. Submittal category (action or informational).
  - 4. Name of subcontractor.
  - 5. Description of the Work covered.
  - 6. Scheduled date for Architect's final release or approval.
- B. Preliminary Construction Schedule: Submit two copies.
  - 1. Approval of cost-loaded preliminary construction schedule will not constitute approval of Schedule of Values for cost-loaded activities.
- C. Preliminary Network Diagram: Submit two copies, large enough to show entire network for entire construction period. Show logic ties for activities.
- D. Contractor's Construction Schedule: Submit two copies of initial schedule, large enough to show entire schedule for entire construction period.
- E. CPM Reports: Concurrent with CPM schedule, submit two copies of each of the following computer-generated reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
  - 1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.



2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
  3. Total Float Report: List of all activities sorted in ascending order of total float.
  4. Earnings Report: Compilation of Contractor's total earnings from the Notice to Proceed until most recent Application for Payment.
- F. Field Condition Reports: Submit two copies at time of discovery of differing conditions.
- G. Special Reports: Submit two copies at time of unusual event.
- 1.5 COORDINATION
- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
  - B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
    1. Secure time commitments for performing critical elements of the Work from parties involved.
    2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

## PART 2 - PRODUCTS

### 2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
  1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
  2. Initial Submittal: Submit concurrently with preliminary network diagram. Include submittals required during the first 60 days of construction. List those required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.
  4. The Owner will review the schedule of submittals and identify the submittals that they want to receive a copy of at the same time that the Architect's copies are sent out.

### 2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Procedures: Comply with procedures contained in AGC's "Construction Planning & Scheduling."
- B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
  1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

- C. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
  2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  4. Startup and Testing Time: Include times for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
  2. Work under More Than One Contract: Include a separate activity for each contract.
  3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
  4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 1 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
  6. Work Restrictions: Show the effect of the following items on the schedule:
    - a. Coordination with existing construction.
    - b. Limitations of continued occupancies.
    - c. Uninterruptible services.
    - d. Partial occupancy before Substantial Completion.
    - e. Use of premises restrictions.
    - f. Provisions for future construction.
    - g. Seasonal variations.
    - h. Environmental control.
    - i. Restriction of noise making operations during final exam weeks.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Mechanical Commissioning, Substantial Completion, and Final Completion.
- F. Cost Correlation: At the head of schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of the Work performed as of dates used for preparation of payment requests.
1. Refer to Division 1 Section "Payment Procedures" for cost reporting and payment procedures.
  2. Contractor shall assign cost to construction activities on the CPM schedule. Costs shall not be assigned to submittal activities unless specified otherwise but may, with Architect's approval, be assigned to fabrication and delivery activities. Costs shall be

under required principal subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.

3. Each activity cost shall reflect an accurate value subject to approval by Architect.
4. Total cost assigned to activities shall equal the total Contract Sum.

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

H. **Computer Software:** Prepare schedules using a program that has been developed specifically to manage construction schedules.

## 2.3 BROAD SCOPE MILESTONE SCHEDULE

A. Submit a separate general broad scope schedule to provide a basic progress report for the Owner's use. Examples of broad scope line items to include are: Site Work, Cast-In-Place Concrete, Framing, Rough MEP, Building Envelope, Interior Finishes, Exterior Finishes, Final MEP, Commissioning, 2 Week IAQ Flush Out, Certificate of Occupancy. Update schedule on a monthly basis for submission at project meetings.

## 2.4 REPORTS

A. **Field Condition Reports:** Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

## 2.5 SPECIAL REPORTS

A. **General:** Submit special reports to Architect within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

# PART 3 - EXECUTION

## 3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.

2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

## SECTION 013300 - SUBMITTAL PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
  - 1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
  - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
  - 3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
  - 4. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
  - 5. Division 01 Section "Closeout Procedures" for submitting warranties.
  - 6. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 7. Divisions 02 through 33 Sections for specific requirements for submittals in those Sections.

#### 1.3 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written information that does not require Architect's responsive action. Submittals may be rejected for not complying with requirements.

#### 1.4 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

- B. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- C. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
1. Initial Review: Allow 15 days minimum for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
  3. Resubmittal Review: Allow 15 days minimum for review of each resubmittal.
  4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days minimum for initial review of each submittal.
- D. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
  2. Provide a space approximately **6 by 8 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
  3. Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.
    - c. Name and address of Architect.
    - d. Name and address of Contractor.
    - e. Name and address of subcontractor.
    - f. Name and address of supplier.
    - g. Name of manufacturer.
    - h. Submittal number or other unique identifier, including revision identifier.
      - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).
    - i. Number and title of appropriate Specification Section.
    - j. Drawing number and detail references, as appropriate.
    - k. Location(s) where product is to be installed, as appropriate.
    - l. Other necessary identification.
- E. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on submittals.
- F. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
  2. Send one additional copy of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.

- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor.
1. Transmittal Form: Provide locations on form for the following information:
    - a. Project name.
    - b. Date.
    - c. Destination (To:).
    - d. Source (From:).
    - e. Names of subcontractor, manufacturer, and supplier.
    - f. Category and type of submittal.
    - g. Submittal purpose and description.
    - h. Specification Section number and title.
    - i. Drawing number and detail references, as appropriate.
    - j. Transmittal number, numbered consecutively.
    - k. Submittal and transmittal distribution record.
    - l. Remarks.
    - m. Signature of transmitter.
  2. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.
- H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
  2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  3. Resubmit submittals until they are approved.
- I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- J. Use for Construction: Use only final submittals with mark indicating approval taken by Architect.

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
1. Mark with dark colored pen that permits photocopying. Do not use highlighter.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Mill reports.
    - j. Standard product operation and maintenance manuals.
    - k. Compliance with specified referenced standards.
    - l. Testing by recognized testing agency.
    - m. Application of testing agency labels and seals.
    - n. Notation of coordination requirements.
  4. Submit Product Data before or concurrent with Samples.
  5. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Architect will return one copy for reproduction and distribution. Mark up and retain one returned copy as a Project Record Document.
    - a. Send one additional copy of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shopwork manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Design calculations.
    - j. Compliance with specified standards.
    - k. Notation of coordination requirements.
    - l. Notation of dimensions established by field measurement.
    - m. Relationship to adjoining construction clearly indicated.
    - n. Seal and signature of professional engineer if specified.
    - o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least **8-1/2 by 11 inches** but no larger than **30 by 40 inches**.
  3. Number of Copies: Submit three opaque copies of each submittal. Architect will retain two copies; Architect will return one copy for reproduction and distribution. Mark up and retain one returned copy as a Project Record Drawing and copies where copies are required for operation and maintenance manuals.



- a. Send one additional copy of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of appropriate Specification Section.
  3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
    - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
  4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit two full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
  5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
    - a. Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
      - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
      - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
      - 3) Send one additional sample(s) of the submittals identified in the Owner's mark-up of the schedule of submittals directly to the Owner at the same time that the Architect's copies are sent out.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
1. Type of product. Include unique identifier for each product.

2. Number and name of room or space.
  3. Location within room or space.
  4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Architect will return one copy for reproduction and distribution.
    - a. Mark up and retain one returned copy as a Project Record Document.
- F. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- G. Submittals Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- H. Application for Payment: Comply with requirements specified in Division 1 Section "Payment Procedures."
- I. Schedule of Values: Comply with requirements specified in Division 1 Section "Payment Procedures."
- J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
1. Name, address, and telephone number of entity performing subcontract or supplying products.
  2. Number and title of related Specification Section(s) covered by subcontract.
  3. Drawing number and detail references, as appropriate, covered by subcontract.
  4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Architect will return one copy.
    - a. Mark up and retain one returned copy as a Project Record Document.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Architect will not return copies.
  2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  3. Test and Inspection Reports: Comply with requirements specified in Division 1 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 1 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 1 Section "Construction Progress Documentation."
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during

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

- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.
- Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- R. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
  - 1. Preparation of substrates.
  - 2. Required substrate tolerances.
  - 3. Sequence of installation or erection.
  - 4. Required installation tolerances.
  - 5. Required adjustments.
  - 6. Recommendations for cleaning and protection.
- S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
  - 1. Name, address, and telephone number of factory-authorized service representative making report.
  - 2. Statement on condition of substrates and their acceptability for installation of product.
  - 3. Statement that products at Project site comply with requirements.
  - 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  - 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - 6. Statement whether conditions, products, and installation will affect warranty.
  - 7. Other required items indicated in individual Specification Sections.
- T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- U. Material Safety Data Sheets (MSDSs): Submit information directly to Owner at end of the project; do not submit to Architect. Maintain copy at the site for the duration of the construction.
  - 1. Architect will not review submittals that include MSDSs and will return them.

## 2.3 DELEGATED DESIGN

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

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

## PART 3 - EXECUTION

### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
  1. The Contractor shall review submittals for completeness and compliance with the Contract Documents. If submittal contains substitutions, Contractor shall process substitutions in accordance with Division 1 Section "Substitutions and Product Options," and not part of specified Shop Drawings or Product Data submittals. Contractor is responsible for keeping Subcontractors on time with the submittal schedule. If the Contractor submits submittals that are repeatedly rejected, requiring the Architect to perform multiple reviews of the same submittal because of the failure to properly prepare and complete the submittals:
    - a. Owner will compensate Architect for such additional services.
    - b. Owner will deduct the amount of such compensation from the final payment to the Contractor.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Owner's Review: The Owner will convey comments regarding select submittals identified in the Owner's mark-up of the schedule of submittals to the Architect.
- C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.
- D. The Architect's marking of "Approved," "Approved as Noted" or similar verbiage means submittal has been reviewed for general conformance to the contract documents only and does

not mean unqualified acceptance. The Contractor is fully responsible for compliance with the contract documents.

- E. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.
- F. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- G. Submittals not required by the Contract Documents may not be reviewed and will be discarded.

END OF SECTION 013300

## SECTION 014000 - QUALITY REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
  - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
  - 4. The Owner will hire an independent firm to do the testing and balancing of the air system and to do mechanical commissioning.
- C. Related Sections include the following:
  - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
  - 2. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting activities.
  - 3. Divisions 02 through 33 Sections for specific test and inspection requirements.

#### 1.3 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where

indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.

- D. Laboratory Mockups: Full-size, physical assemblies that are constructed at testing facility to verify performance characteristics.
- E. Preconstruction Testing: Tests and inspections that are performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- F. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with industry standards.
- G. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- H. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- I. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- J. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
  - 1. Using a term such as "carpentry" does not 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 tradespeople of the corresponding generic name.
- K. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### 1.4 CONFLICTING REQUIREMENTS

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



## 1.5 SUBMITTALS

- A. Qualification Data: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Description of test and inspection.
  - 3. Identification of applicable standards.
  - 4. Identification of test and inspection methods.
  - 5. Number of tests and inspections required.
  - 6. Time schedule or time span for tests and inspections.
  - 7. Entity responsible for performing tests and inspections.
  - 8. Requirements for obtaining samples.
  - 9. Unique characteristics of each quality-control service.
- C. Reports: Prepare and submit certified written reports that include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and re-inspecting.
- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

## 1.6 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

- D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.
- F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirement for specialists shall not supersede building codes and regulations governing the Work.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 548; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

- J. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
  2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
  3. Demonstrate the proposed range of aesthetic effects and workmanship.
  4. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
    - a. Allow seven days for initial review and each re-review of each mockup.
  5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  6. Demolish and remove mockups when directed, unless otherwise indicated.
- K. Laboratory Mockups: Comply with requirements of preconstruction testing and those specified in individual Sections in Divisions 2 through 16.

## 1.7 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
  2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
  3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
    - a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
  4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 1 Section "Submittal Procedures."

- D. Retesting/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- E. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  - 1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
  - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
  - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
  - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
  - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
  - 6. Do not perform any duties of Contractor.
- F. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
  - 1. Access to the Work.
  - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
  - 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - 4. Facilities for storage and field curing of test samples.
  - 5. Delivery of samples to testing agencies.
  - 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- H. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality-control services required by the Contract Documents. Submit schedule within 30 days of date established for commencement of the Work.
  - 1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## 1.8 SPECIAL TESTS AND INSPECTIONS

- A. Special Tests and Inspections: Owner will engage a qualified testing agency to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, in compliance with applicable building code.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
  - 1. Date test or inspection was conducted.
  - 2. Description of the Work tested or inspected.
  - 3. Date test or inspection results were transmitted to Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
  - 1. Comply with the Contract Document requirements for Division 1 Section "Cutting and Patching."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

## SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.

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

1. Sanitary facilities, including toilet facilities.
2. Heating facilities.
3. Ventilation.
4. Electric power service.
5. Lighting.
6. Telephone service.
7. Internet service.

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

1. Waste disposal facilities.
2. Lifts and hoists.
3. Construction aids and miscellaneous services and facilities.
4. Snow removal.

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

1. Tree and plant protection.
2. Security enclosure and lockup.
3. Barricades, warning signs, and lights.
4. Dust protection.
5. Fire protection.

- E. Related Sections include the following:

1. Division 01 Section "Execution Requirements" for progress cleaning requirements.
2. Divisions 02 through 33 for temporary heat, ventilation, and humidity requirements for products in those Sections.

#### 1.3 USE CHARGES

- A. Electric Power Service, Water Service and Heat: The use of existing power, water and heat will be allowed for the Work without charge in the existing building.
  1. The use of existing power for electric space heaters and welding equipment will not be permitted.

## 1.4 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
  - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
  - 2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. The Contractor is responsible for the implementation, monitoring, and maintenance of job site safety program for the duration of the contract.

## 1.5 PROJECT CONDITIONS

- A. Temporary Utilities: At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.
  - 1. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
  - 1. Keep temporary services and facilities clean and neat.
  - 2. Relocate temporary services and facilities as required by progress of the Work.
- C. Restrict use of noise-making tools and equipment to hours that will minimize complaints from persons or firms near the site. Construction noise from loud machinery, equipment, hammering and similar loud noises shall be restricted to the hours of when the facility is not in use. Obey State and local noise ordinances.
- D. Elevator: Use of the existing elevator will not be permitted.

## PART 2 - PRODUCTS

### 2.1 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- C. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.

- D. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide gas/oil indirect fired space heaters that are UL labeled and approved for construction space heating by appropriate agency. Provide adequate ventilation and thermostatic control. Heaters shall be located outside the building and combustion gases shall be vented outside the building. Maintain observation of units in operation.
  - 1. Use of kerosene and gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
- E. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- F. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- G. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination where existing lighting is not available. Provide guard cages where exposed to breakage.

## 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.
  - 1. Coordinate with the Architect and Owner at the preconstruction meeting.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. Water Service: Obtain water required for the work from location designated by the Owner.
- B. Sanitary Facilities:
  - 1. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of Owner's existing toilet facilities will not be permitted.
- C. Heating: Heating will be by existing heating system within the facility. Provide temporary protection to reduce heat loss for the work where existing construction is disturbed at exterior openings. Provide additional temporary heating if required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
  - 1. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed. Maintain higher minimum temperatures before,



- during, and after installations of materials and finishes as specified in the individual specification Sections.
2. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation and filters are in place. Provide and pay for replacement of filters.
- D. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- E. Temporary Electric Power Service:
1. Provide grounded electric power distribution of sufficient size, capacity, and power characteristics during construction period, connecting to existing campus power service at location designated by owner.
- F. Temporary Lighting: Use of existing lighting will be permitted.
1. Provide temporary lighting that will provide adequate illumination for construction operations and traffic conditions. A minimum of 80 foot candles shall be supplied at mid-height of surfaces for taping, painting and finish work.
- G. Telephone Service: Provide cellular telephone service with voice mail throughout construction period.
- H. Internet Service: Provide laptop computer at the site. Internet connection is available at the college campus. Coordinate with Owner for connection to the college service. Limit use of service to authorized personnel only, for specific project business only.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. Project Identification and Temporary Signs: Prepare Project identification signs. Install signs to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
1. Prepare temporary signs to provide directional information to construction personnel and visitors.
- B. Waste Disposal Facilities: Provide waste-collection dumpsters and containers in sizes adequate to handle waste from construction and demolition operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with Division 01 Section "Execution Requirements" for progress cleaning requirements.
1. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.
  2. Develop a waste management plan for Work performed on Project. Indicate types of waste materials Project will produce and estimate quantities of each type. Provide detailed information for on-site waste storage and separation of recyclable materials. Provide information on destination of each type of waste material and means to be used to dispose of all waste materials.
- C. Contractor Field Office and Storage Sheds: If Contractor requires a field office trailer and storage trailers, coordinate available location on campus with the Owner.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of the building and exterior openings. Provide temporary enclosures to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior. Provide temporary enclosures to prevent unauthorized entry into the building through exterior openings.
  - 1. Building shall remain protected and watertight. Water damage shall be corrected by the Contractor at no cost to the Owner.
- E. Temporary Dust Partitions:
  - 1. Provide temporary dust partitions isolating the work from occupied spaces before starting any demolition and remove after new work is completed. Obtain approval from Architect and Owner before removal of partitions.
  - 2. Construct temporary dust partitions out of metal studs and 1/2" fire-retardant plywood on one side. Seal all gaps and around perimeter with duct tape. Temporary doors for partitions shall be 3'-0" x 6'-8" hollow core doors with standard mortise hardware, closers, weatherstripping and keyed locksets to match Owner's. Insulate partition to provide noise protection to occupied areas.
  - 3. All Temporary dust partitions in place less than 3 days may be Cirvico fire-retardant vinyl and adequately supported sealed with duct tape.
  - 4. Hang vinyl around area while stud and plywood temporary partition is being constructed.
  - 5. Insulate and weatherproof temporary partitions exposed to exterior and exposed to unheated spaces.
- F. Furniture Removal and Protection:
  - 1. The Owner will remove all movable furniture, equipment and contents of fixed open shelving prior to start of work by Contractor. Contractor shall cover nonremovable casework and equipment with 6 mil polyethylene to protect from dust and dirt, and other measures to protect and prevent damage as required by the Contractor's work plan, means and methods to do the work. Cover countertops and tops of shelving with plywood or similar protective covering at locations where overhead demolition and construction could land and cause damage.
  - 2. At Minor Renovation Areas and Access for Mechanical and Electrical : Contractor shall move furniture out of the way and cover furniture, shelving and equipment with 6 mil

polyethylene to protect from dust and dirt. The Owner will remove books and papers from open shelves requiring relocation.

3. Prevent workers from standing on fixed casework, shelving, furniture and equipment, and from using same to support staging planks, ladders and other equipment. Contractor is responsible for damage caused by workers.
  - a. If the Contractor fails to keep workers from using fixed casework, shelving, furniture and equipment to stand on, or to support staging planks, ladders and other equipment for access to the work, the Owner shall serve notice to the Contractor, and the Contractor shall at the request of the Owner, remove fixed item from the work spaces, store, and return back to the original locations upon completion of the work, or shall build protective enclosures, at no additional cost to the Owner.

- G. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  1. Provide fire extinguishers, visible and accessible from space being served.
  2. Store combustible materials in containers in fire-safe locations.
  3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
  4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition. Provide fire watchman for cutting and welding operations.
  5. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Instruct personnel in methods and procedures. Post warnings and information.

### 3.5 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. Protect from damage caused by freezing temperatures and similar elements.
  1. Maintain operation of temporary enclosures, heating, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  2. Prevent water-filled piping from freezing.
  3. Snow removal: Provide snow removal necessary to do the work and maintain access to temporary facilities.
- C. Flooring Protection: Protect new flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during construction period. Use protection methods indicated or recommended by flooring manufacturer.
  1. Cover finish flooring surfaces with undyed, untreated building paper and provide required protection that prevents damage from construction operations at high traffic areas and at work areas until inspection for Substantial Completion.
  2. Do not move heavy and sharp objects directly over flooring. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

- D. Restoration of Roadways and Pavement: Roadways, pavements and curbs that are broken, damaged, settled, or otherwise defective as a result of receiving, handling, storage of materials or the performance of any work under this Contract, shall be fully restored to the satisfaction of the authorities having jurisdiction.
  
- E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. 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 the property of Contractor.
  - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

## SECTION 016000 - PRODUCT REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 01 Section "Substitutions and Product Options" for procedures and requirements for product substitutions.
  - 2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
  - 3. Divisions 02 through 33 Sections for specific requirements for warranties on products and installations specified to be warranted.

#### 1.3 DEFINITIONS

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

#### 1.4 SUBMITTALS

- A. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
  - 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

#### 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

#### 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on

product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. **Special Warranty:** Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
  2. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
  3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. **Submittal Time:** Comply with requirements in Division 1 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT SELECTION PROCEDURES

- A. **General Product Requirements:** Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  2. **Standard Products:** If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected," Architect will make selection.
  5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
  6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
  7. **Or Equal:** Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. **Product Selection Procedures:**
1. **Product:** Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
  2. **Manufacturer/Source:** Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
  3. **Products:** Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.

4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
  - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
  - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that does not include premium items.
  - b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

### PART 3 - EXECUTION (Not Used)

END OF SECTION 016000



## SECTION 016300 - SUBSTITUTIONS AND PRODUCT OPTIONS

### PART 1 GENERAL

#### 1.1 DESCRIPTION

- A. Substitution procedures during the bid period shall be followed to provide equality of bids. Substitutions approved by the Architect will be issued by addendum during the bid period. Substitutions not approved by addendum shall not be included in the bid. The Architect and Owner will not consider substitutions submitted after bids are received. Contractors submitting substitutions after bids are received will not be given additional compensation for rejected submittals.

#### 1.2 SUBSTITUTIONS

- A. Submit two copies of request for substitution. Include in the request:
1. Complete data substantiating compliance of proposed substitution with Contract Documents.
  2. For Products:
    - a. Product identification including manufacturer's name and address.
    - b. Manufacturer's Literature:
      - (1) Product description.
      - (2) Performance and test data.
      - (3) Reference standards.
    - c. Samples.
    - d. Name and address of similar projects on which product was used, and date of installation.
  3. Itemized comparison of product substitution with product specified.
  4. Changes in construction schedule.
  5. Accurate cost data on proposed substitution in comparison with product specified.
- B. In Making Request for Substitution, the Contractor Represents:
1. Contractor has investigated proposed product or method and determined that it is equal or superior in all respects to that specified.
  2. Contractor will provide the same or greater guarantee for substitution as for product specified.
  3. Contractor will coordinate installation of accepted substitution into work, making such changes as required for work to be completed.
  4. Contractor waives all claims for additional costs related to substitution in which it becomes apparent before, during or after installation.
  5. Requested substitution is compatible with other portions of the Work. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified and is acknowledged in the substitution request
  6. Contractor requesting substitution shall bear additional costs to all parties due to his substitution, including Architect's fees.

C. Substitutions Will Not Be Considered If:

1. They are indicated or implied on shop drawings or project submittals without formal request.
2. Acceptance will require substantial revision of Contract Documents.
3. Not readily serviceable in the area or may cause the Owner to stock extra parts.

D. Substitutions not approved before the last addendum is distributed shall not be considered in the Base Bid.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

END OF SECTION 016300

SUBSTITUTION REQUEST FORM

Project: \_\_\_\_\_ Substitution Request Number: \_\_\_\_\_  
To: \_\_\_\_\_ From: \_\_\_\_\_  
Re: \_\_\_\_\_ Date: \_\_\_\_\_  
Specification Title: \_\_\_\_\_ Description: \_\_\_\_\_

Section: \_\_\_\_\_ Page: \_\_\_\_\_ Article/Paragraph: \_\_\_\_\_

Proposed Substitution: \_\_\_\_\_

Manufacturer: \_\_\_\_\_ Address: \_\_\_\_\_ Phone: \_\_\_\_\_  
Trade Name: \_\_\_\_\_ Model No. \_\_\_\_\_

Attached data includes product description, specifications, drawings, cost data, and performance and test data adequate for evaluation of the request: applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitutions will require for its proper installation.

Attached data includes a detailed itemized comparison list of product substitution with product specified.

The Undersigned certifies:

1. Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified product.
2. Will provide the same warranty for the Substitution as for the specified Product.
3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner. All sizes, dimensions, locations for connections to other items as designed, clearances from building structure and other equipment have been verified.
4. Will remove substitution and pay all costs if differences discovered later that were not identified on the substitution request are found that make the substitution unacceptable with no additional cost to Owner.
5. Waive claims for additional costs or time extension that may subsequently become apparent.
6. Will reimburse Owner and Architect/Engineer for review or redesign services associated with substitution.
7. They are authorized to sign this form for the product manufacturer, and commit to the terms of Section ASubstitutions and Product Options,@ and this substitution request form.

Submitted By: \_\_\_\_\_

Signed By: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_ Fax: \_\_\_\_\_

A/E's REVIEW AND ACTION

- .. Submission approved - Make submittals in accordance with Specification Section 013300.
- .. Submission approved as noted - Make submittals in accordance with Specification Section 013300.
- .. Submission rejected - Use specified materials.
- .. Submission request received too late - Use specified materials.

Signed by: \_\_\_\_\_ Date: \_\_\_\_\_

Supporting Data Attached:

- .. Drawings .. Product Data .. Samples .. Tests .. Reports
- .. Comparison list .. Other

## SECTION 017300 - EXECUTION REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  1. General installation of products.
  2. Coordination of Owner-installed products.
  3. Progress cleaning.
  4. Starting and adjusting.
  5. Protection of installed construction.
  6. Correction of the Work.
- B. Related Sections include the following:
  1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
  2. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
  3. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

### PART 2 - PRODUCTS (Not Used)

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
- B. Existing Systems: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of utilities and other construction affecting the Work.
- C. Acceptance of Conditions: 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. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
  - a. Description of the Work.
  - b. List of detrimental conditions, including substrates.
  - c. List of unacceptable installation tolerances.
  - d. Recommended corrections.
2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

### 3.2 PREPARATION

- A. 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.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

### 3.3 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  1. Verification: Before proceeding to layout the Work, verify layout information shown on Drawings. If discrepancies are discovered, notify Architect promptly.
  2. Make vertical work plumb and make horizontal work level.
  3. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
  4. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
  5. Maintain minimum headroom clearance of **8 feet** in spaces without a suspended ceiling, unless indicated otherwise.
- 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. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. 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.
- G. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
  - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
  - 2. Allow for building movement, including thermal expansion and contraction.
  - 3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- H. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- I. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
  - 1. No asbestos containing materials shall be used in the work.

### 3.4 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.
- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces.
  - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
  - 2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

### 3.5 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. 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 materials more than 7 days during normal weather or 3 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.
- 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. It is the Contactor's responsibility for job site safety.
    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.
      - a. Clean interior spaces prior to the start of finish painting, and continue cleaning on an as-needed basis until painting is finished.
      - b. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly coated surfaces.
    3. Remove materials and debris that create tripping hazards.
  - 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: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
  - H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
  - I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
  - J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.6 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- 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: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."
- E. Comply with Division 01 Section "Integrated Deliverables and Testing (IDAT)" requirements.

### 3.7 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

### 3.8 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 1 Section "Cutting and Patching."
  - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restore permanent facilities used during construction to their specified condition.
- C. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- D. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- E. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300



## SECTION 017329 - CUTTING AND PATCHING

### 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. This Section includes procedural requirements for cutting and patching.
  - 1. For correction of installed work.
  - 2. For repairs due to testing.
- B. Related Sections include the following:
  - 1. Division 02 Section "Selective Demolition and Alterations" for demolition of selected portions of the building and additional patching requirements.
  - 2. Divisions 02 through 33 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

#### 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 surfaces to original conditions after installation of other Work.

#### 1.4 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least 10 days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
  - 1. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with original structure.
  - 2. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

#### 1.5 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. 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. Operating elements include the following:
  - 1. Primary operational systems and equipment.

2. Air or smoke barriers.
3. Fire-suppression systems.
4. Mechanical systems piping and ducts.
5. Control systems.
6. Communication systems.
7. Conveying systems.
8. Electrical wiring systems.

- C. **Miscellaneous Elements:** Do not cut and patch miscellaneous elements or related 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. Miscellaneous elements include the following:
1. Water, moisture, or vapor barriers.
  2. Membranes and flashings.
  3. Equipment supports.
  4. Piping, ductwork, vessels, and equipment.
  5. Noise- and vibration-control elements and systems.
- D. **Visual Requirements:** Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.
- E. **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.

## 1.6 WARRANTY

- A. **Existing Warranties:** Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. **General:** Comply with requirements specified in other Sections.
- B. **In-Place Materials:** Use materials 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 match the visual and functional performance of in-place materials.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
  - 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
  - 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. 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.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

### 3.3 PERFORMANCE

- A. 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. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
  - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to 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: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
  - 4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
  - 5. Proceed with patching after construction operations requiring cutting are complete.
- C. 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 possible. Provide materials and comply with installation requirements specified in other Sections.
  - 1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
    - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    - b. Restore damaged pipe covering to its original condition.
  3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces. 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, apply primer and intermediate paint coats 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.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

## SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT

### 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 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.

#### 1.03 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.

#### 1.04 PERFORMANCE GOALS

- A. General: Develop waste management plan that results in end-of-Project rates for salvage/recycling of not less than 75 percent by weight of total waste generated by the Work.

#### 1.05 SUBMITTALS

- A. Waste Management Plan: Submit 3 copies of plan within 7 days of date established for commencement of the Work .
- B. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit three copies of report. Include the following information:
  1. Material category.

2. Generation point of waste.
  3. Total quantity of waste in tons.
  4. Quantity of waste salvaged, both estimated and actual in tons.
  5. Quantity of waste recycled, both estimated and actual in tons.
  6. Total quantity of waste recovered (salvaged plus recycled) in tons.
  7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.
- C. Waste Reduction Calculations: Before request for Substantial Completion, submit three copies of calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
- D. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.
- E. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.
- F. 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.
- G. 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.

#### 1.06 QUALITY ASSURANCE

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

#### 1.07 WASTE MANAGEMENT PLAN

- A. General: Develop plan consisting of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume, but use same units of measure throughout waste management plan.

- B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing and construction waste generated by the Work. Include estimated quantities and assumptions for estimates.
- C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.
  - 1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
  - 2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
  - 4. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.
  - 5. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
  - 6. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location on Project site where materials separation will be located.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.01 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.
  - 1. Comply with Division 1 Section "Temporary Facilities and Controls" for operation, termination, and removal requirements.
- B. Waste Management Coordinator: Engage a waste management coordinator to be responsible for implementing, monitoring, and reporting status of waste management work plan. Coordinator shall be present at Project site full time for duration of Project.
- C. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work occurring at Project site.
  - 1. Distribute waste management plan to everyone concerned within three days of submittal return.
  - 2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.
- D. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Division 1 Section "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

### 3.02 RECYCLING DEMOLITION AND CONSTRUCTION WASTE, GENERAL

- A. General: Recycle paper and beverage containers used by on-site workers.
- B. Packaging:
  1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
  2. Polystyrene Packaging: Separate and bag materials.
  3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
  4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
- C. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical.
  1. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
    - a. Inspect containers and bins for contamination and remove contaminated materials if found.
  2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
  4. Store components off the ground and protect from the weather.
  5. Remove recyclable waste off Owner's property and transport to recycling receiver or processor.

### 3.03 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 017419



## SECTION 017700 - CLOSEOUT PROCEDURES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Warranties.
  - 3. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
  - 2. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
  - 3. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
  - 4. Divisions 02 through 33 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

#### 1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements.
  - 3. 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.
  - 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 Owner. Advise Owner's personnel 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 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.
15. Submit initial draft copy of operation and maintenance manuals at least 15 days before requesting inspection for Substantial Completion.

B. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for Final Completion.

#### 1.4 FINAL COMPLETION

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

1. Submit a final Application for Payment according to Division 1 Section "Payment Procedures."
2. 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.
3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 INSPECTION FEES

A. If the Architect Performs Reinspections Due to Failure of the Work to Comply with the Claims of Status of Completion Made by the Contractor, Or, Should the Contractor fail to complete the work, Or, Should the Contractor fail to promptly correct warranty items or work later found to be deficient:

1. Owner will compensate Architect for such additional services.
2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

B. If the Work is not completed by the date set in the Agreement, and the Architect needs to perform additional Contract Administrative and on site observation duties:

1. Owner will compensate Architect for such additional services.

2. Owner will deduct the amount of such compensation from the final payment to the Contractor.

#### 1.6 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

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

#### 1.7 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated in the contract documents.
  1. Unless indicated otherwise, all warranties shall commence on the date of Substantial Completion.
- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

### PART 3 - EXECUTION

#### 3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
  - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
  - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - e. Remove snow and ice to provide safe access to building.
  - f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - h. Sweep concrete floors broom clean in unoccupied spaces.
  - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
  - j. Resilient flooring shall be scrubbed and cleaned with cleaner recommended by the flooring manufacturer just prior to occupation by Owner. No-wax floors shall be buffed in accordance with flooring manufacturer's requirements.
  - k. Floors to receive wax shall be waxed just prior to occupation by Owner. Waxing shall consist of three coats, properly buffed to a uniform sheen. Work shall be done by a floor care subcontractor. Coordinate selection of wax with flooring manufacturer and Owner's maintenance program.
  - l. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - m. Remove labels that are not permanent.
  - n. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
    - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - o. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - p. Replace parts subject to unusual operating conditions.
  - q. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
  - r. Replace disposable air filters and clean permanent air filters that are exposed to the work. Clean exposed surfaces of diffusers, registers, and grills.
  - s. Clean ducts, blowers, and coils if units were operated without filters during construction.
  - t. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and

defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

u. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

## SECTION 017823 - OPERATION AND MAINTENANCE DATA

### PART 1 - GENERAL

#### 1.01 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.

#### 1.02 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Operation manuals for systems, subsystems, and equipment.
  - 3. Maintenance manuals for the care and maintenance of products, materials, and finishes, systems and equipment.
- B. Related Sections include the following:
  - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
  - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 4. Divisions 02 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

#### 1.03 DEFINITIONS

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

#### 1.04 SUBMITTALS

- A. Initial Submittal: Submit 2 draft copies of each manual at least 15 days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Architect will review concurrently with Owner for comment. Architect will return copy of draft and mark whether general scope and content of manual are acceptable.
- B. Final Submittal: Submit 2 copies of each manual in final form at least 15 days before final inspection. Architect will review concurrently with Owner for comment. Architect will return copy with comments after final inspection.
  - 1. Correct or modify each manual to comply with comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.

- C. Preliminary Operation and Maintenance Manual Summary: Submit two copies concurrently with the submittal of the Schedule of Values in accordance with Division 01 section, "Submittal Procedures."

## 1.05 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

## PART 2 - PRODUCTS

### 2.01 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

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

### 2.02 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor and primary subcontractors.

6. Name and address of Architect.
  7. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders: Heavy-duty, D-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents but not greater than 2 inches, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets. Do not over fill D-ring, allowing 1/2-inch space for future additions.
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
  3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
  5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. Fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
- E. Electronic Media: Submit one copy of each complete manual, including Record Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the specifications table of contents and manual dividers.
- F. Follow ASHRAE Guideline 4 - 2008 in the preparation of operating and maintenance documentation.



## 2.03 EMERGENCY MANUALS

- A. Content: Emergency information that must be immediately available during emergency situations to protect life and property and to minimize disruptions to building occupants. Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.
- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

## 2.04 OPERATION MANUALS

- A. Content: Daily operations and management of systems and equipment. In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.

4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

## 2.05 PRODUCT MAINTENANCE MANUAL

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## 2.06 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  - 1. Standard printed maintenance instructions and bulletins.
  - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  - 3. Identification and nomenclature of parts and components.
  - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  - 1. Test and inspection instructions.
  - 2. Troubleshooting guide.
  - 3. Precautions against improper maintenance.
  - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - 5. Aligning, adjusting, and checking instructions.
  - 6. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  - 1. Include procedures to follow and required notifications for warranty claims.

## PART 3 - EXECUTION

### 3.01 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
- G. Comply with Division 1 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

## SECTION 017839 - PROJECT RECORD DOCUMENTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Record Shop Drawings.
- B. Related Sections include the following:
  - 1. Division 01 Section "Closeout Procedures" for general closeout procedures.
  - 2. Divisions 02 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

#### 1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit copies of Record Drawings as follows:
    - a. Submit one set(s) of marked-up Record Prints
- B. Record Specifications: Submit one hard copy and one copy on electronic media of Project's Specifications, including addenda and contract modifications.
- C. Record Shop Drawings and Product Data: Submit one hard copy and one copy on electronic media of each Product Data submittal.
  - 1. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit marked-up Shop Drawings and Product Data as an insert in manual instead of submittal as Record Shop Drawings and Product Data. Insert typewritten pages indicating typewritten pages indicating drawing titles, descriptions of contents, and Record Shop Drawings and Product Data locations drawing locations that are part of operation and maintenance manuals.
  - 2. Electronic Media: In addition to paper copy, submit record copy of record Shop Drawings and Product Data specification on CD-R in .PDF format. Bookmark Product Data based on the table of contents.
- D. Directories: Material supplier directory and subcontractor directory.+

## PART 2 - PRODUCTS

### 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made by Change Order or Construction Change Directive.
    - k. Changes made following Architect's written orders.
    - l. Details not on the original Contract Drawings.
    - m. Field records for variable and concealed conditions.
    - n. Record information on the Work that is shown only schematically.
  3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.

### 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions, change orders and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, Record Product Data, and Record Drawings where applicable.
6. Electronic Media: Submit record copy of record specification on CD-R in .PDF format. Bookmark based on the table of contents.

### 2.3 RECORD SHOP DRAWINGS AND PRODUCT DATA

- A. Preparation: Mark Shop Drawings and Product Data to indicate the actual product installation where installation varies substantially from that indicated in Shop Drawings and Product Data submittal.
  1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.
  4. Bind product data in heavy-duty, D-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents but not greater than 2 inches, and sized to receive 8-1/2-by-11-inch paper. Do not over fill D-ring, allowing 1/2 inch space for future additions.
  5. Provide heavy paper dividers with plastic-covered tabs for each specification section with product data. Mark tab to identify the specification section. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
  6. Identify each binder on the front and spine with the typed or printed title "PRODUCT DATA," Project name, and name of Contractor.
  7. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. Maximum size of drawings to be included in the binders shall not exceed 11-by-17-inch. Fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and submit envelopes with manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.
  8. Electronic Media: Submit record copy of marked-up Shop Drawings and Product Data on CD-R in .PDF format. Bookmark based on the table of contents, and for each Shop Drawings and Product Data within each section. Where Record Shop Drawings and Product Data is required as part of operation and maintenance manuals, submit electronic media of marked-up Shop Drawings and Product Data as part of manual instead of submittal as Record Shop Drawings and Product Data.

### 2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

- B. Subcontractor Directory: Name, address and telephone number for all major subcontractors, organized by specification section.
- C. Material Supplier Directory: Name, address and telephone number for major material suppliers, organized by specification section.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION 017839



## SECTION 017900 - DEMONSTRATION AND TRAINING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
  - 1. Demonstration of operation of systems, subsystems, and equipment.
  - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Sections include the following:
  - 1. Division 01 Section "Project Management and Coordination" for requirements for preinstruction conferences.
  - 2. Divisions 02 through 33 Sections for specific requirements for demonstration and training for products in those Sections.

#### 1.3 SUBMITTALS

- A. Attendance Record: For each training session, submit list of participants.

#### 1.4 QUALITY ASSURANCE

- A. Demonstrator and Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 1 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

#### 1.5 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate providing notification of dates, times, length of instruction time, and training content.
- C. Coordinate content of training with content of approved operation and maintenance manuals.

### PART 2 - PRODUCTS

#### 2.1 INSTRUCTION PROGRAM

- A. Program: Develop an instruction program that includes individual training for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:

1. HVAC systems equipment.
  2. Lighting equipment and controls.
  3. Fire Alarm System.
- B. Training Modules: Include instruction as applicable for the following:
1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
    - a. System, subsystem, and equipment descriptions.
    - b. Performance and design criteria if Contractor is delegated design responsibility.
    - c. Operating standards.
    - d. Regulatory requirements.
    - e. Equipment function.
    - f. Operating characteristics.
    - g. Limiting conditions.
    - h. Performance curves.
  2. Documentation: Review the following items in detail:
    - a. Operations and maintenance manuals.
    - b. Project Record Documents.
    - c. Warranties and bonds.
    - d. Maintenance service agreements and similar continuing commitments.
  3. Emergencies: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Instructions on stopping.
    - c. Shutdown instructions for each type of emergency.
    - d. Operating instructions for conditions outside of normal operating limits.
    - e. Sequences for electric or electronic systems.
    - f. Special operating instructions and procedures.
  4. Operations: Include the following, as applicable:
    - a. Instructions on meaning of warnings, trouble indications, and error messages.
    - b. Startup procedures.
    - c. Equipment or system break-in procedures.
    - d. Routine and normal operating instructions.
    - e. Regulation and control procedures.
    - f. Control sequences.
    - g. Safety procedures.
    - h. Instructions on stopping.
    - i. Normal and emergency shutdown instructions.
    - 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:
    - a. Alignments.
    - b. Checking adjustments.
    - c. Noise and vibration adjustments.
    - d. Economy and efficiency adjustments.
  6. Troubleshooting: Include the following:
    - a. Diagnostic instructions.
    - b. Test and inspection procedures.
  7. Maintenance: Include the following:
    - a. Inspection procedures.
    - b. Types of cleaning agents to be used and methods of cleaning.

- c. List of cleaning agents and methods of cleaning detrimental to product.
- d. Procedures for routine cleaning
- e. Procedures for preventive maintenance.
- f. Procedures for routine maintenance.
- g. Instruction on use of special tools.
- 8. Repairs: Include the following:
  - a. Diagnosis instructions.
  - b. Repair instructions.
  - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
  - d. Instructions for identifying parts and components.
  - e. Review of spare parts needed for operation and maintenance.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Assemble materials necessary for instruction.
- B. Set up instructional equipment at instruction location.

### 3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
  - 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
  - 1. Schedule training with Owner with at least fifteen days' advance notice.

END OF SECTION 017900

**Sample**

(Modify objectives and agenda subjects for systems and equipment being covered)

**TRAINING AND ORIENTATION AGENDA**

Project: \_\_\_\_\_

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

Equipment / System: \_\_\_\_\_ Spec Section: \_\_\_\_\_

**Section 1. Audience and General Scope**

Intended audience type (enter number of staff): \_\_\_ facility manager, \_\_\_ facility engineer, \_\_\_ facility technician, \_\_\_ project manager, \_\_\_ tenant, \_\_\_ other: \_\_\_\_\_

**General objectives and scope of training:** (check all that apply)

- \_\_\_ A. Provide an overview of the purpose and operation of this equipment, including required interactions of trainees with the equipment.
- \_\_\_ B. Provide technical information regarding the purpose, operation and maintenance of this equipment at an intermediate level, expecting that serious malfunctions will be addressed by factory reps.
- \_\_\_ C. Provide technical information regarding the purpose, operation, troubleshooting and maintenance of this equipment at a very detailed level, expecting that almost all operation, service and repair will be provided by the trainees.

**Section 2. Instructors**

<u>ID</u>	<u>Trainer</u>	<u>Company</u>	<u>Position / Qualifications</u>
1)	_____	_____	_____
2)	_____	_____	_____
3)	_____	_____	_____

**Section 3. Agenda** [The responsible contractors have their trainers fill out this section and submit to Owner and Commissioning Agent for review and approval prior to conducting training.]

Location: \_\_\_ site \_\_\_\_\_ Date \_\_\_\_\_  
\_\_\_ classroom (location) \_\_\_\_\_, Date \_\_\_\_\_

<u>Agenda of general subjects covered</u>	<u>Duration</u>	<u>Instructor</u>	<u>Completed</u>
(√ all that will be covered)	(√ when completed)	(min.)	(ID)
___ General purpose of this system or equipment (design intent)	_____	_____	_____
___ Review of control drawings and schematics (have copies for attendees)	_____	_____	_____
___ Startup, loading, normal operation, unloading, shutdown, unoccupied operation, seasonal changeover, etc., as applicable	_____	_____	_____
___ Integral controls (packaged): programming, troubleshooting, alarms, manual operation	_____	_____	_____

___ Building automation controls (BAS): programming, troubleshooting, alarms, manual operation, interface with integral controls	_____	_____	_____
___ Interactions with other systems, operation during power outage and fire	_____	_____	_____
___ Relevant health and safety issues and concerns and special safety features	_____	_____	_____
___ Energy conserving operation and strategies	_____	_____	_____
___ Any special issues to maintain warranty	_____	_____	_____
___ Common troubleshooting issues and methods, control system warnings and error messages, including using the control system for diagnostics	_____	_____	_____
___ Special requirements of tenants for this equipment's function	_____	_____	_____
___ Service, maintenance, and preventative maintenance (sources, spare parts inventory, special tools, etc.)	_____	_____	_____
___ Question and answer period	_____	_____	_____

**Other subjects covered, specific to the equipment:**

**Duration   Instructor   Completed**

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

**Total duration of training (hrs)** ----->

**Training methods that will be included (clarify as needed):** (Trainer checks all that apply)

- \_\_\_ use of the O&M manuals, illustrating where the verbal training information is found in writing
- \_\_\_ each attendee will be provided: 1) the control drawing schematic and sequence of operations; 2) a copy of this agenda.
- \_\_\_ discussion/lecture at site \_\_\_\_\_
- \_\_\_ site demonstration of equipment operation \_\_\_\_\_
- \_\_\_ written handouts \_\_\_\_\_
- \_\_\_ manufacturer training manuals \_\_\_\_\_
- \_\_\_ classroom lecture \_\_\_\_\_
- \_\_\_ classroom hands-on equipment \_\_\_\_\_
- \_\_\_ video presentation \_\_\_\_\_
- \_\_\_ question and answer period \_\_\_\_\_

**Section 4. Approvals and Use** [Once the Agenda has been filled out by the Trainer, the Owner and Commissioning Agent review, make edits, sign and return to Contractor who provides to the Trainer for use during training. Copies of Agenda shall be provided to trainees.]

This plan has been approved by the following individuals, subject to the additions and clarifications noted in the left columns marked "add." (This is not an approval of training completion.)

\_\_\_\_\_  
Owner's Representative                      Date                      \_\_\_\_\_

\_\_\_\_\_  
Commissioning Agent                      Date                      \_\_\_\_\_

## SECTION 018120 - INTEGRATED DELIVERABLES AND TESTING (IDAT)

### 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. This Section includes the monitoring, documentation and scheduling process for ensuring that building systems perform interactively according to the design intent and the owner's operational needs.
- B. Related Sections include the following:
  - 1. Division 01 Section "Quality Requirements" for general administrative and procedural requirements for quality assurance and quality control.
  - 2. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
  - 3. Division 01 Section "Demonstration and Training" for demonstration, training and documentation procedures.

#### 1.3 DEFINITIONS

- A. A/E: Includes Architect/Engineer identified in the Contract for Construction between Owner and Contractor, plus consultant/design professionals responsible for design of HVAC, electrical, communications, controls for HVAC systems, and other related systems.
- B. CxA: Commissioning Agent hired by Owner for mechanical systems.
- C. CC: Controls Contractor.
- D. CM: Construction Manager/(General) Contractor.
- E. EC: Electrical Contractor.
- F. FT: Functional Performance Test / Post Installation Checklist.
- G. IDAT: Integrated Deliverables And Testing Plan.
  - 1. The IDAT plan and associated schedule is the master document that describes the results of the monitoring, documentation and scheduling process for ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. The process of IDAT during construction is intended to achieve the following specific objectives in conformance with the Contract Documents:
    - a. Ensure that applicable equipment and systems are installed as specified and receive adequate Prefunctional and Functional operational checkout by Contractor and installing subcontractors.
    - b. Verify and document proper performance of equipment and systems.
    - c. Ensure that operation and maintenance manuals are complete.

d. Ensure that the Owner's operating personnel are adequately trained.

H. MC: Mechanical Contractor.

I. Mfr: Equipment Manufacturer/Vendor.

J. PC: Prefunctional Checklist.

K. PO: USM Plant Operator/Engineer.

L. PM: USM-Project Manager (Owner).

M. Subs: Subcontractors to CM.

N. TAB: Testing, Adjusting, and Balancing.

#### 1.4 IDAT TEAM RESPONSIBILITIES

A. The members of the IDAT team consists primarily of the CM, PM, PO, A/E (particularly the mechanical engineer), the mechanical subcontractor, electrical subcontractor, TAB representative, controls subcontractor, any other installing subcontractors or suppliers of equipment.

B. General description of the IDAT responsibilities are as follows:

1. A/E: Perform construction observation, reviews submittals, test results, operation and maintenance manuals and assist in resolving problems. Assists and supports the IDAT process and gives final verification of the IDAT work in conjunction with the Owner.
2. CM: Provides and coordinates the IDAT administrative process, prepares construction-phase IDAT plan, writes or has tests reports prepared, oversees and documents performance tests. Facilitates the IDAT process, ensuring that Subs perform their responsibilities and integrates IDAT into the construction process and coordinated with overall Project schedule.
  - a. Ensures testing, quality assurance and functional verifications are performed, and results are in conformance with the contract documents.
  - b. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
  - c. Prepare attendance lists, and notifying participants.
3. Mfr: Equipment manufacturers and vendors provide documentation to facilitate the IDAT work and perform contracted startup.
4. PM: Perform construction observation, review and approve operation and maintenance manuals, reviews submittals and test results and assist in resolving problems. Assists and supports the IDAT process and reviews final testing and deliverables of the IDAT work in conjunction with the A/E and CM.
5. Subs: Demonstrate proper system performance in accordance with pre-functional and functional test procedures. Assist testing and commissioning operations as required by the contract documents.



## 1.5 INTEGRATED DELIVERABLES AND TESTING PLAN PROCESS

- A. Initial IDAT Meeting: CM shall plan out and conduct a meeting within 30 days of the beginning of construction. In attendance shall be the authorized representatives of the CM, CA, PM, A/E, Mfr. of major equipment, and the mechanical, electrical, controls, and TAB contractor. Hold the conference at Project site or another convenient location. The goal of the meeting is to increase understanding by all parties of the IDAT process, their respective responsibilities, and provide the CM with information required to finalize the IDAT plan and schedule.
  - 1. Agenda: Include the following:
    - a. Parties are introduced and contact information provided for each authorized representative assigned to the IDAT team.
    - b. IDAT process reviewed, with management, communications and reporting lines determined. Participant questions and issues addressed.
    - c. Review of document flow, how much and when submittal data will be received and approved.
    - d. General list of each party's responsibilities. (Example: Assign who is responsible to develop the startup plan for each piece of equipment or system.)
    - e. Proposed IDAT schedule.
- B. Specific testing of materials specified in the Division 2 thru 33 sections and procedures described in Section "Quality Requirements" are separate from the IDAT process. In some cases, the verification of these tests may be included in the pre-functional/pre-installation checklist to verify completion of a system before it is incorporated and made inaccessible by the Work. (Example: Air/vapor barrier inspection completed before permanently concealed by masonry installation.)

## 1.6 INTEGRATED DELIVERABLES AND TESTING PLAN

- A. Integrated Deliverables and Testing Plan: A document, prepared by CM, that outlines the schedule, allocation of resources, and documentation requirements of the integrated deliverables and testing, and shall include, but is not limited to the following:
  - 1. Plan for delivery and review of submittals, systems manuals, and other documents and reports. Identification of the relationship of these documents to other functions and a detailed description of submittals that are required to support the IDAT processes. Submittal dates shall include the latest date approved submittals must be received without adversely affecting IDAT plan.
  - 2. Description of the organization, layout, and content of documentation, and a detailed description of documents to be provided along with identification of responsible parties.
  - 3. Identification of systems, materials and equipment to be monitored, inspected, tested and documented.
  - 4. Description of schedules for testing procedures along with identification of parties involved in performing and verifying tests.
  - 5. Identification of items that must be completed before the next operation can proceed.
  - 6. Description of responsibilities of team members.
  - 7. Description of observations to be made.
  - 8. Description of expected performance for systems, subsystems, equipment, and controls.
  - 9. Schedule for activities with specific dates coordinated with overall construction schedule. Include coordination meetings for assembly of parties involved with the preparation of Certificate of Readiness and at periodic intervals with all participants to review project IDAT status.

10. Identification of installed systems, subsystems, and equipment, including design changes that occurred during the construction phase.
  11. Step-by-step procedures for checklists, inspections, testing systems, subsystems, and equipment with descriptions for methods of verifying relevant data, recording the results obtained, and listing parties involved in performing and verifying tests.
- B. Certificate of Readiness: Certificate of Readiness for each Installation Checklist shall be prepared and signed by CM and Subs certifying that systems, subsystems, equipment, and associated construction are ready for testing and verification.
- C. Installation Checklists: Develop checklists for each system, subsystem, or equipment. Include a separate entry, with space for comments, for each item to be verified. Provide space for participants and personnel to sign off on each checklist. See sample Installation Checklist included at the end of this section. Each checklist, regardless of system, subsystem, or equipment being verified, shall include, but not be limited to, the following:
1. Name and identification of item.
  2. Checklist number.
  3. Time and date of verification.
  4. Location of system, subsystem, or equipment being tested or verified.
  5. Indication of whether the record is for a first test/verification or retest/reinspection following correction of a problem or issue.
  6. Dated signatures of the person performing test and inspections and of the witness, if applicable.
  7. Individuals present.
- D. Corrective Action Report: When system, subsystem, or equipment being tested/verified was found to not comply with the contract documents, prepare a Corrective Action Report for listing of deficiencies. See sample Corrective Action Report included at the end of this section.
1. Correlate report with related Installation Checklist.
  2. List deficiencies and issues.
  3. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
  4. Identify expected date of correction.
  5. State that correction was completed and system, subsystem, and equipment is ready for retest/verification.
  6. Log date correction is completed or the issue is resolved.
  7. Identify person(s) who corrected or resolved the issue.
  8. Identify person(s) documenting the issue resolution.

## 1.7 SUBMITTALS

- A. IDAT Plan Prefinal Submittal: CM shall submit two hard copies of prefinal commissioning plan, and two sets of electronically formatted information. Present submittal in sufficient detail to evaluate data collection and arrangement process. One copy, with review comments, will be returned to the CM for preparation of the final construction-phase commissioning plan.
- B. Commissioning Plan Final Submittal: CM shall submit two hard copies and two sets of electronically formatted information of final commissioning plan. Deliver one hard copy and one set of discs to Owner, and one copy to Architect. The final submittal must address previous review comments. The final submittal shall include a copy of the prefinal submittal review comments along with a response to each item.

- C. Installation Checklists and Report Forms: CM shall submit sample checklists and forms to subcontractors for review and comment before submitting to Architect. Submit two hard copies and two sets of electronically formatted checklist and report form. Forms will be reviewed by Architect and Owner for content. Review comments, will be returned to the CM for preparation of the final construction-phase Installation Checklists.
  - 1. Submit completed and signed forms upon completion of each Installation Checklist.
- D. Certificates of Readiness: CM shall submit Certificates of Readiness to all parties involved in the system, subsystem, or equipment being tested/verified.
- E. Corrective Action Reports: CM shall submit Corrective Action Reports to all parties involved in the system, subsystem, or equipment being tested/verified.
- F. See Section “Project Record Documents” for preparation of complete record of submittals for project record documents.

## 1.8 COORDINATION

- A. Coordinating Meetings: CM shall conduct coordination meetings as scheduled with the IDAT team to review progress on the IDAT plan, to discuss scheduling conflicts, and to discuss upcoming activities.
- B. Pre-functional Meetings: CM shall conduct pre-functional meetings with the Subs to review readiness of system, subsystem, or equipment being tested/verified, and issuance of the Certificates of Readiness.
- C. Testing Coordination: CM shall coordinate sequence of testing activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
  - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- D. Manufacturers' Field Services: CM shall coordinate services of manufacturers' field services.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 SAMPLE INSTALLATION CHECKLISTS

- A. The CM shall include the following as part of the project checklists developed for the IDAT Plan:
  - 1. Blocking
    - a. Pre-functional / Pre-installation Checklist
      - 1) Metal framing installed, ready to receive blocking.
      - 2) Shop drawing for items to be supported are complete with heights and locations of blocking identified.
    - b. Functional Performance Test / Post-installation Checklist
      - 1) Blocking in size and thickness required has been installed for all items, including:

- a) Door Stops.
  - b) Window treatment.
  - c) Tack boards and Marker boards.
  - d) Shelving.
  - e) Millwork and custom casework.
  - f) Building specialties.
  - g) Owner furnished items.
  - h) Storefront blocking.
  - i) Window sills.
  - j) Drywall window return shims.
  - k) Countertop supports.
  - l) Panel board supports.
  - m) Miscellaneous items.
2. Doors and Hardware
- a. Pre-functional / Pre-installation Checklist
    - 1) Frames are properly anchored, square, plumb, and in alignment.
    - 2) Painting is complete before installation of hardware, including hinges.
    - 3) Fire-rating labels are exposed and unpainted.
    - 4) Conduct walk thru with Owner's security contractor and USM campus hardware specialists to review security contractor supplied equipment requirements and conditions.
    - 5) Coordination meeting with USM campus hardware specialist, review of Owner furnished off line locksets.
    - 6) Submittals for doors, frames, aluminum entrances, and door hardware coordinated and completed.
  - b. Functional Performance Test / Post-installation Checklist
    - 1) Correct door and fire-rating installed in opening.
    - 2) Door closers properly installed, arms in correct position, back check, closing speed and latching speed properly set, covers installed and secure.
    - 3) Spring hinges set to proper tension, with tension similar throughout facility. Verify two spring hinges supplied for each door leaf schedule to receive spring hinges.
    - 4) Door stops fastened to solid blocking.
    - 5) Locks, exit devices and other hardware functioning properly. Door clearances correct, free of rubbing frames and floor surfaces.
    - 6) Pairs of doors properly spaced and dead latching feature is functioning properly.
3. Ceilings
- a. Pre-functional / Pre-installation Checklist
    - 1) Work above ceiling is complete, including:
      - a) Duct work, dampers, diffusers.
      - b) Condit, piping, cabling.
      - c) Fire stopping.
      - d) Fire rating stenciled on walls above ceilings.
      - e) Light fixture installation complete.
      - f) Safety hanger wire supports for fixtures installed.
  - b. Functional Performance Test / Post-installation Checklist
    - 1) Grid layout installed to reflected ceiling plan.
    - 2) Grid hangers properly spaced and hung from structure.
    - 3) Exposed edges of acoustical tile finished.
    - 4) Hold-down clips installed at required locations.

- 5) Escutcheons properly covering openings and cutouts.
  - 6) Ceiling tile and grid inspected for marks and damage.
4. Floor Coverings
- a. Pre-functional / Pre-installation Checklist
    - 1) Adequate lighting levels available for visual inspections and installation.
    - 2) Proper environmental conditions scheduled and provided for application and curing of adhesives, including temperature, humidity, ventilation, airborne dust and contaminants.
    - 3) Surface temperatures of substrates maintained within floor covering manufacturer's requirements. Process set up to monitor and record temperatures of substrates, and air temperatures before, during and after installation.
    - 4) Work that could damage floors by other trades is complete before start of installation.
    - 5) Project schedule is coordinated to complete work by other trades and vacate areas receiving floor coverings stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing/drying period of floor coverings.
    - 6) Moisture tests, if required, are complete and in compliance with specified requirements.
    - 7) Gypsum board is within specified distance to floor for proper support of resilient wall base.
    - 8) Saw cuts, cracks and openings properly filled to support floor covering, surface imperfections in substrate filled and leveled to prevent telegraphing thru floor covering.
    - 9) Surfaces are clean, free of dirt and grit that will telegraph thru floor covering.
  - b. Functional Performance Test / Post-installation Checklist
    - 1) Floor covering is complete, run into recesses and properly terminated at transitions.
    - 2) Joints and seams are tight.
    - 3) Adhesive trowel marks do not telegraph thru floor covering.
    - 4) Resilient wall base complete within room, including toe kick spaces of casework. Joints are tight, top of base is straight and aligned.
    - 5) Proper protection provided for completed floors.
    - 6) Final cleaning and waxing operations complete.
5. Painting
- a. Pre-functional / Pre-installation Checklist
    - 1) Adequate lighting levels available for visual inspections and application.
    - 2) Proper environmental conditions maintained for application and drying of coatings, including temperature, humidity, ventilation, airborne dust and contaminants.
    - 3) Inspect walls for dents and imperfections, with gypsum board installer and painter.
    - 4) Gypsum board touch up of dents and imperfections completed.
    - 5) Rooms are broom-clean, surfaces have been dusted, including wall surface, ledges, sills, tops of door frames.
    - 6) Cover plates removed.
    - 7) Fire-rating labels masked.

- 8) Benchmark sample rooms, coating and colors are complete and approved before start of painting operations.
- b. Functional Performance Test / Post-installation Checklist
  - 1) Inspect walls for dents and imperfections, with gypsum board installer and painter after prime coat.
  - 2) Gypsum board touch up of dents and imperfections completed and primer applied to touch ups.
  - 3) Primers and coating continually being checked for proper application mil thickness.
  - 4) Inspect completed surfaces for compliance with benchmark samples. Damaged and marred surfaces of completed work touched-up just before Owner occupation.
  - 5) Cover plates installed.
  - 6) Color mix codes submitted.
6. Lighting Equipment and Controls.
  - a. Refer to Sections 230900 and 260149.
  - b. Pre-functional / Pre-installation Checklist
    - 1) Coordination meeting with Owner and Contractors.
    - 2) Verify that all boxes and conduits are installed.
    - 3) Verify that all line voltage circuits are in place ready for termination
  - c. Functional Performance Test / Post-installation Checklist
    - 1) Verify that all junction boxes have been properly covered/closed.
    - 2) Verify that all line voltage connections have been made.

END OF SECTION 018120

**Sample  
Installation Checklist**

Project \_\_\_\_\_

IC-\_\_\_\_ Air/Vapor Barrier Location \_\_\_\_\_

**1. Submittal / Approvals**

**Submittal.** The above material and systems integral to them are complete and ready for installation of exterior finishes. The checklist items are complete and have been checked off only by parties having direct knowledge of the event, as marked below, respective to each responsible contractor. This checklist is submitted for record, subject to an attached list of outstanding items yet to be completed. A Statement of Correction will be submitted upon completion of any outstanding areas. \_\_\_\_\_ List attached.

General Contractor	Date	Air/Vapor Barrier Contractor	Date
--------------------	------	------------------------------	------

Checklist items are to be completed as part of preparatory work before installation of masonry and metal wall panels..

- This checklist does not take the place of the manufacturer’s recommended checkout and installation procedures.
- Items that do not apply shall be noted with the reasons on this form (N/A = not applicable, BO = by others).
- If this form is not used for documenting, one of similar rigor shall be used.
- Contractors assigned responsibility for sections of the checklist shall be responsible to see that checklist items by their subcontractors are completed and checked off.
- “Contr.” column or abbreviations in brackets to the right of an item refer to the contractor that to verified completion of this item. All = all contractors, GC = general contractor, IS = Installing Contractor, EC = electrical contractor

**Approvals.** This filled-out checklist has been reviewed. Its completion is approved with the exceptions noted below.

General Contractor	Date	Owner’s Representative	Date
--------------------	------	------------------------	------

Owner’s Inspection Agency	Date
---------------------------	------

Notes:

**2. Requested documentation submitted**

Check if Okay. Enter comment or note number if deficient.

Check						Contr.
Manufacturer's Product Data						
Shop Drawings showing interface with adjacent components						
Installer Qualification Data						
Additional Checks:						

- *Documentation complete as per contract documents for given trade .....  YES  NO*

**3. Installation Checks**

Check if Okay. Enter comment or note number if deficient.

Check						Contr.
<b>Prefunctional / Pre-installation Checklist</b>						
Blocking complete						
Sheathing in compliance with specified requirements						
Adjacent materials ready for A/V barrier installation						
Additional Checks:						
<b>Functional Performance Test / Post-installation Checklist</b>						
Sheathing joints properly prepped and detailed						
Tie in to adjacent material completed						
Application to field of wall completed						
Completed area inspected and approved by Independent testing agency						
Additional Checks:						
Test Description:						
Results:						

- *The checklist items of Part 3 are all successfully completed.....  YES  NO*

-- END OF CHECKLIST--



**University of Southern Maine  
Integrated Deliverables and Testing Plan  
Corrective Action Report**

Project: \_\_\_\_\_ ID: \_\_\_\_\_ Date: \_\_\_\_\_

Equipment: \_\_\_\_\_ Equipment ID: \_\_\_\_\_

Identified from: \_\_\_ Test, \_\_\_ Review, \_\_\_ Discussion \_\_\_, \_\_\_ Site visit \_\_\_

The above equipment has been observed, tested or the performance report reviewed and was found to not comply with the contract documents.

Deficiencies or Issues and Effects:

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

Corrective Action: \_\_\_ Required \_\_\_ Recommended.

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

For testing to proceed in a timely manner, it is imperative that the required corrective action be completed by:

\_\_\_\_\_  
 Date or Event

IDTP	CM Agent	Date	PM / Owner's Representative	Date
------	----------	------	-----------------------------	------

Forwarded to the following parties on \_\_\_\_\_ for corrective action:  
 Date

Attachments: Yes \_\_\_ No \_\_\_ Comment: \_\_\_\_\_

**Distribution**

The following checked individuals will receive these documents for action, review and/or approval as appropriate:

<u>Party</u>	<u>For review &amp; comment only</u>	<u>For review &amp; action</u>	<u>For record only</u>
CM	_____	_____	_____
Harriman	_____	_____	_____
USM, Dana A. Gray	_____	_____	_____
USM, Dave Schurman	_____	_____	_____
USM,	_____	_____	_____
	_____	_____	_____
	_____	_____	_____



## SECTION 019500 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

### PART 1 - GENERAL

#### 1.1 FOR INFORMATION ONLY

- A. The testing, adjusting and balancing (TAB) Agent shall be contracted directly with the Owner. This Specification section has been included for information only, to inform the Contractor that testing, adjusting and balancing will be performed on the mechanical systems and that the Contractor is responsible for assisting and coordinating with the TAB Agency as described in this section. Testing, Adjusting and Balancing shall be carried out and coordinated through the IDAT plan.

#### 1.2 SECTION INCLUDES

- A. Testing, Adjustment, and Balancing of Air Systems.
- B. Testing, Adjustment, and Balancing of Hydronic Piping Systems.
- C. Measurement of Final Operating Condition of HVAC Systems.

#### 1.3 RELATED SECTIONS

- A. Section 014000 – Quality Requirements: Testing laboratory services: Employment of testing agency and payment for services.
- B. Section 017700 – Project Closeout.
- C. Division 23 – Warranty:
  - 1. TAB warranties shall conform to guidelines indicated in Division 23 with all references to Mechanical Contractor changes to TAB Contractor.

#### 1.4 REFERENCES

- A. AABC - National Standards for Total System Balance.
- B. ADC - Test Code for Grilles, Registers, and Diffusers.
- C. ASHRAE 111 - Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilation, Air-conditioning, and Refrigeration Systems.
- D. NEBB - Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.
- E. SMACNA - HVAC Systems Testing, Adjusting, and Balancing.
- F. IDAT – Integrated Deliverables And Testing Plan

## 1.5 SUBMITTALS

- A. Submit under provisions of Division 01 Section “Submittal Procedures.”
- B. Design Review Reports:
  - 1. Submit prior to commencement of construction under provisions of Division 01 Section “Quality Requirements.”
  - 2. Review the Contract Documents, and indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
- C. Preliminary Report Submittals:
  - 1. Prior to commencing work of this Section, and no more than 30 days after approval of TAB Agency submittals, submit report forms or outlines indicating adjusting, balancing, and equipment data required, with columns of design data filled in. By means of plan views, equipment profiles, and similar graphical descriptions, indicate where measurements will be taken.
  - 2. Submit the procedures to be used.
- D. Field Reports: Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect/Engineer and for inclusion in operating and maintenance manuals.
- E. Provide reports in letter size, 3-ring binder manuals, complete with index page and indexing tabs, with cover identification at front and side. Include set of reduced drawings with air outlets and equipment identified to correspond with data sheets, and indicating thermostat locations.
- F. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.
- G. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, forms prepared following ASHRAE 111, or NEBB forms.

## 1.6 QUALITY ASSURANCE

- A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance, ASHRAE 111 or NEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.
- B. Instrument Calibration: Calibrate instruments every 6 months, or more frequently if Manufacturer requires same.

## 1.7 QUALIFICATIONS

- A. Agency: Company specializing in the testing, adjusting, and balancing of systems specified in this Section with minimum three years experience and certified by AABC or NEBB, or equivalent experience which would qualify for membership in these testing organizations. Agency shall be listed under paragraph 3.1 AGENCIES in this Section.
- B. Perform Work under supervision of registered Professional Engineer experienced in performance of this Work and licensed in Maine.

## 1.8 SEQUENCING

- A. Sequence work under the provisions of Division 01 Section "Summary."
- B. Sequence work to commence after completion of systems or portions of work, and schedule completion of work before Substantial Completion of Project.

## PART 2 - PRODUCTS (Not Used)

## PART 3 - EXECUTION

### 3.1 AGENCIES

- A. Tekon Technical Consultants, Rochester, NH. Contact: Charles Corlin, (603) 335-3080.
- B. No Substitutions.

### 3.2 EXAMINATION

- A. Verify that systems are complete and operating correctly in accordance with sequence of operations before commencing work. Ensure the following conditions:
  - 1. Systems are started and operating in a safe and normal condition.
  - 2. Temperature control systems are installed complete and operable.
  - 3. Proper thermal overload protection is in place for electrical equipment.
  - 4. Duct systems are clean of debris.
  - 5. Fans are rotating correctly.
  - 6. Fire and volume dampers are in place and open.
  - 7. Air coil fins are cleaned and combed.
  - 8. Access doors are closed and duct end caps are in place.
  - 9. Air outlets are installed and connected.
  - 10. Duct system leakage is minimized.
  - 11. Hydronic systems are flushed, filled, and vented.
  - 12. Pumps are rotating correctly.
  - 13. Proper strainer baskets are clean and in place.
  - 14. Service and balance valves are open.
- B. Submit field reports. Report to the responsible Subcontractors, defects and deficiencies noted during performance of services which prevent system balance. Submit list of locations where the Contractor needs to provide additional balancing devices.
- C. Beginning of work means acceptance of existing conditions.

### 3.3 PREPARATION

- A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.

### 3.4 INSTALLATION TOLERANCES

- A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 5 percent of design for return and exhaust systems.
- B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
- C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

### 3.5 ADJUSTING

- A. Ensure recorded data represents actual measured or observed conditions.
- B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
- E. For belt driven equipment, provide sheave and belt modifications and/or replacements as required to ensure design flow rates as specified.

### 3.6 AIR SYSTEM PROCEDURE

- A. Adjust air handling and distribution systems to provide design supply, return, and exhaust air quantities.
- B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.
- C. Measure air quantities at air inlets and outlets.
- D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
- E. Use volume control devices to regulate air quantities only to extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.
- F. Vary total system air quantities by adjustment of fan speeds. Vary branch air quantities by damper regulation.
- G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
- H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

- I. Adjust outside air automatic dampers, return air, and exhaust dampers for design conditions. Adjust at minimum position and maximum position, and use manual dampers and actuator limit stops to minimize differences.
- J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.
- K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
- L. Coordinate with Division 23 Section "Instrumentation and Controls for HVAC" for calibration of air handling units= static pressure sensors and determination of pressure setpoints.
- M. Set pattern-control vanes and other devices in air inlets and outlets to provide the spread and throw patterns indicated, without objectionable noise or air motion to the occupants. Split the flow of linear slot diffusers in directions as required for good coverage. At completion, patterns shall be uniform and pleasing to the eye.

### 3.7 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing.
- F. Where available pump capacity is less than total flow requirements of individual system parts (due to system diversity), full flow in one part may be simulated by temporary restriction of flow to other parts.
- G. Coordinate with Division 23 Section "Instrumentation and Controls for HVAC" for calibration of pump static pressure sensors and determination of pressure setpoints.
- H. When the available pump head is more than 15% above the required head to meet the design flow, trim the pump impeller to bring the head within 100 to 110 percent of the required head to meet the design flow. At least one balancing valve in the system, and one balancing valve per each multi-circuit sub-main branch served by a branch balancing valve, shall be fully open when balancing is complete.

### 3.8 VERIFICATION OF DUCT LEAKAGE TESTING

- A. The TAB Agent shall witness the duct leakage tests performed under Division 23 Section “Metal Ducts.” At a minimum, the first duct leakage test shall be witnessed and approved by the TAB Agent and the Engineer. At a minimum, subsequent duct leakage tests shall be witnessed and approved by the TAB Agent. The TAB Agent shall confirm proper testing procedures and shall give written approval to leakage tests. If deficiencies are discovered, the TAB Agent shall document these deficiencies to the Contractor and the Engineer. Once deficiencies are corrected, the TAB Agent shall witness follow-up leakage tests.

### 3.9 COORDINATION OF SERVICES

- A. The General Contractor and his Subcontractors shall be responsible for providing the following assistance to the TAB Agent:
  - 1. Provide access to the Contractor=s on site ladders and man-lifts as required to allow access to required equipment by the TAB Agent.
  - 2. Keep the TAB Agent informed of the project schedule and ensure that adequate notice is given to the TAB Agent to allow for the proper testing, adjusting and balancing of mechanical systems before ceilings are flooded or access to systems is otherwise obstructed.
  - 3. Ensure that adequate time is allotted in the project schedule to allow for the proper testing, adjusting and balancing of the mechanical systems.
  - 4. Coordinate with the TAB Agent to correct system deficiencies that are discovered by the TAB Agent. Notify the TAB Agent once system deficiencies are corrected.

### 3.10 PROJECT CLOSEOUT

- A. At final inspection, recheck random selections of data recorded in IDAT report. Recheck points or areas as selected and witnessed by the Architect.
  - 1. Check and adjust systems approximately six months after final acceptance and submit final IDAT report. Systems shall be rechecked and adjusted during each season.
  - 2. Retests: If random tests elicit a measured flow deviation of ten percent or more from that recorded in the certified report listings, at ten percent or more of the rechecked selections, the report shall be automatically rejected. In the event the report is rejected, systems shall be readjusted and tested, new data recorded, new certified reports submitted, and new inspection tests made.
  - 3. System shall be verified for proper performance 90 days after Owner acceptance.
- B. Provide instrument calibration reports by type used for air and water procedures and dates of last

### 3.11 SCHEDULES

- A. Equipment Requiring Testing, Adjusting, and Balancing:
  - 1. HVAC Pumps
  - 2. Gas Fired Boiler
  - 3. Packaged Rooftop Air Conditioning Unit
  - 4. Hot Water Unit Heaters
  - 5. Baseboard Radiation
  - 6. Hot Water Heating Coil



7. Energy Recovery Ventilator
8. Air Inlets and Outlets

B. Report Forms:

1. Title Page:
  - a. Name of Testing, Adjusting, and Balancing Agency
  - b. Address of Testing, Adjusting, and Balancing Agency
  - c. Telephone number of Testing, Adjusting, and Balancing Agency
  - d. Project name
  - e. Project location
  - f. Project Architect
  - g. Project Engineer
  - h. Project Contractor
  - i. Project altitude
  - j. Report date
2. Summary Comments:
  - a. Design versus final performance
  - b. Notable characteristics of system
  - c. Description of systems operation sequence
  - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
  - e. Nomenclature used throughout report
  - f. Test conditions
3. Instrument List:
  - a. Instrument
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Range
  - f. Calibration date
4. Electric Motors:
  - a. Manufacturer
  - b. Model/Frame
  - c. HP/BHP
  - d. Phase, voltage, amperage; nameplate, actual, no load
  - e. RPM
  - f. Service factor
  - g. Starter size, rating, heater elements
  - h. Sheave Make/Size/Bore
5. V-Belt Drive:
  - a. Identification/location
  - b. Required driven RPM
  - c. Driven sheave, diameter and RPM
  - d. Belt, size and quantity
  - e. Motor sheave diameter and RPM
  - f. Center to center distance, maximum, minimum, and actual
6. Pump Data:
  - a. Identification/number
  - b. Manufacturer
  - c. Size/model

- d. Impeller
  - e. Service
  - f. Design flow rate, pressure drop, BHP
  - g. Actual flow rate, pressure drop, BHP
  - h. Discharge pressure
  - i. Suction pressure
  - j. Total operating head pressure
  - k. Shut off, discharge and suction pressures
  - l. Shut off, total head pressure
7. Heating Coil Data:
- a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Water flow, design and actual
  - g. Water pressure drop, design and actual
  - h. Entering water temperature, design and actual
  - i. Leaving water temperature, design and actual
  - j. Entering air temperature, design and actual
  - k. Leaving air temperature, design and actual
  - l. Air pressure drop, design and actual
8. Air Moving Equipment:
- a. Location
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Arrangement/Class/Discharge
  - f. Air flow, specified and actual
  - g. Return air flow, specified and actual
  - h. Outside air flow, specified and actual
  - i. Total static pressure (total external), specified and actual
  - j. Inlet pressure
  - k. Discharge pressure
  - l. Sheave Make/Size/Bore
  - m. Number of Belts/Make/Size
  - n. Fan RPM
9. Return Air/Outside Air Data:
- a. Identification/location
  - b. Design air flow
  - c. Actual air flow
  - d. Design return air flow
  - e. Actual return air flow
  - f. Design outside air flow
  - g. Actual outside air flow
  - h. Return air temperature
  - i. Outside air temperature
  - j. Required mixed air temperature
  - k. Actual mixed air temperature

- l. Design outside/return air ratio
- m. Actual outside/return air ratio
- 10. Exhaust Fan Data:
  - a. Location
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Air flow, specified and actual
  - f. Total static pressure (total external), specified and actual
  - g. Inlet pressure
  - h. Discharge pressure
  - i. Sheave Make/Size/Bore
  - j. Number of Belts/Make/Size
  - k. Fan RPM
- 11. Duct Traverse:
  - a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air temperature
  - j. Air correction factor

END OF SECTION 019500

## SECTION 024119 - SELECTIVE STRUCTURE DEMOLITION AND ALTERATIONS

### 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. This Section includes the following:
  1. Demolition and removal of selected portions of a building or structure.
  2. Disconnecting, capping or sealing, and abandoning utilities.
  3. Repair procedures for selective demolition operations.
  4. Protection of existing materials exposed to the weather from damage.
  5. Patching and repairs.
- B. Related Sections include the following:
  1. Division 01 Section "Temporary Facilities and Controls" for furniture protection and temporary dust protection requirements.
  2. Division 01 Section "Cutting and Patching" for additional cutting and patching procedures for selective demolition operations.
  3. Division 01 Section "Project Record Documents" for documentation of capped utilities and other subsurface structural, electrical or mechanical conditions.
  4. Division 21, 22, 23 and 26 Sections for additional requirements regarding demolishing, cutting, patching, or relocating electrical items.

#### 1.3 DEFINITIONS

- A. Remove: Remove and legally dispose of items except those indicated to be reinstalled, salvaged, or to remain the Owner's property.
- B. Remove and Salvage: Items indicated to be removed and salvaged remain the Owner's property. Remove, clean, and pack or crate items to protect against damage. Identify contents of containers and deliver to Owner's designated storage area.
- C. Remove and Reinstall: Remove items indicated; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall items in the same locations or in locations indicated.
- D. Existing to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by the Architect, items may be removed to a suitable, protected storage location during selective demolition and then cleaned and reinstalled in their original locations.

#### 1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

- B. Carefully remove items indicated to be salvaged in a manner to prevent damage and deliver promptly to the Owner.

#### 1.5 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittals."
- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- C. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.
- D. Schedule of Selective Demolition Activities: Indicate the following:
  - 1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
  - 2. Interruption of utility services. Indicate how long utility services will be interrupted.
  - 3. Coordination for shutoff, capping, and continuation of utility services.
  - 4. Detailed sequence of selective demolition and removal work to ensure uninterrupted progress of Owner's on-site operations.
  - 5. Coordination of Owner's continuing occupancy of portions of existing building.
  - 6. Locations of temporary partitions and means of egress.
  - 7. Coordination of removals with the installation of new materials to prevent unauthorized entry into the building, and for protection of existing materials and finishes to remain from damage from the weather.
- E. Inventory of items to be removed and salvaged.
- F. Inventory of items to be removed by Owner.
- G. Record Drawings at Project closeout according to Division 01 Section "Project Record Documents."
  - 1. Identify and accurately locate capped utilities and other subsurface or hidden structural, electrical, or mechanical conditions.
- H. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

#### 1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed

for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- D. Standards: Comply with ANSI A10.6 and NFPA 241.
- E. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination." Review methods and procedures related to selective demolition including, but not limited to, the following:
  - 1. Inspect and discuss condition of construction to be selectively demolished.
  - 2. Review structural load limitations of existing structure.
  - 3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
  - 4. Review shoring sequencing for maintaining existing structure without damage during removal of existing floor systems and structural components.
  - 5. Review methods of protecting remaining surfaces in weathertight conditions without damage during selective demolition operations and ensuing time frame until exterior envelope can be made permanently weathertight.
  - 6. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
  - 7. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
  - 8. Provide 5 business days minimum advance notice to participants prior to convening predemolition conference.

#### 1.7 PROJECT CONDITIONS

- A. Owner will occupy portions of the building immediately adjacent to selective demolition area. Conduct selective demolition so that Owner's operations will not be disrupted. Provide not less than 72 hours' to Owner of activities that will affect Owner's operations.
- B. Maintain access to existing walkways, and other adjacent occupied or used facilities.
  - 1. Do not close or obstruct walkways, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
- C. Owner assumes no responsibility for condition of areas to be selectively demolished.
  - 1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- E. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
  - 1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

- F. Storage or sale of removed items or materials on-site will not be permitted.
- G. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
  - 1. Maintain fire-protection facilities in service during selective demolition operations.

## 1.8 SCHEDULING

- A. Arrange selective demolition schedule so as not to interfere with Owner's on-site operations.

## PART 2 - PRODUCTS

### 2.1 REPAIR MATERIALS

- A. Use repair materials identical to existing materials.
  - 1. If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
  - 2. Use materials whose installed performance equals or surpasses that of existing materials.
- B. Comply with material and installation requirements specified in individual Specification Sections.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to the Architect.
- E. Engage a professional engineer to survey condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
  - 1. Engineer shall develop shoring and underpinning plans and procedures for removal of structural components indicated to be removed.
- F. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or videotapes.
  - 1. Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

2. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.
- G. Verify existing grilles and diffusers are covered with filter material or capped to prevent the entrance of dirt and dust into duct work and ventilation system.
- H. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

### 3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
  1. Do not interrupt existing utilities serving occupied or operating facilities, except when authorized in writing by Owner or authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to governing authorities.
    - a. Provide not less than 72 hours' notice to Owner if shutdown of service is required during changeover.
- B. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
  1. Owner will arrange to shut off indicated utilities when requested by Contractor.
  2. Where utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
  3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
  4. Existing piping, conduit, and panels to remain that are supported by walls and ceilings to be demolished, shall be temporarily re-supported to the existing structure until permanent construction is in place.
- C. Utility Requirements: Refer to Division 21, 22, 23 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.

### 3.3 PREPARATION

- A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
  1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities outside limits of Work, as defined on Drawings, without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by Owner or governing regulations.
  2. Protect existing site improvements, appurtenances, and landscaping to remain.
- B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.



1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
  2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
    - a. Damage due to failure of weather protection shall be repaired or replaced as applicable at no additional cost to the Owner.
  3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations. Surfaces damaged by demolition and construction operations shall be repaired.
- C. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, unauthorized entry, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- D. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures and provide exhaust ventilation to limit dust and dirt migration and to separate areas from fumes and noise.
- E. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.
1. Strengthen or add new supports when required during progress of selective demolition.
- F. Core Drilling and Saw Cutting: All penetrations shall be fully planned and coordinated by the Contractor. Vacuum up water created by cutting operations to prevent damage to materials to remain.
- G. Enclose openings to the exterior and to unconditioned spaces to prevent heat loss and maintain temperature at an acceptable level for Owner.
- H. Furniture Removal and Dust Protection: See Division 01 Section "Temporary Facilities and Controls" for furniture protection and temporary dust protection requirements.

### 3.4 POLLUTION CONTROLS

- A. Dust Control: Use water mist, temporary enclosures, and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations.
1. Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
- B. Disposal: Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
1. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

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

### 3.5 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
  - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations and welding operations, and remain after until chance of fire has past.
  - 5. Maintain adequate ventilation when using cutting torches.
  - 6. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
  - 7. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
  - 8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
  - 9. Break up and remove concrete slabs on grade where indicated.
  - 10. Dispose of demolished items and materials promptly. On-site storage or sale of removed items is prohibited.
  - 11. Remove and replace or reinstall existing construction as necessary to permit installation and alteration of mechanical and electrical work. Coordinate all removals with appropriate trades.
- B. Existing Facilities: Comply with Owner's requirements for using and protecting stairs, walkways, building entries, and other building facilities during selective demolition operations.
- C. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI-WP and its Addendum.
  - 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI.

### 3.6 BRACING

- A. Locate bracing to clear columns, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

- B. Do not place bracing where it will be cast into or included in permanent work, except as otherwise acceptable to Architect.
- C. Install internal bracing, if required, to prevent spreading or distortion to braced frames.
- D. Maintain bracing until structural elements are rebraced by other bracing or until permanent construction is able to withstand pressures.

### 3.7 PATCHING AND REPAIRS

- A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.
- B. Patching: Comply with this section and additional requirements in Division 01 Section "Cutting and Patching."
- C. Work Exposed to View: Do not cut or patch in a manner that would, in the Architect's opinion, result in a lessening of the building's aesthetic qualities. Generally, cut from exposed side into concealed spaces to avoid unnecessary damage to finish. Do not cut and patch in a manner that would result in substantial visual evidence of cut and patch work. Restore exposed finishes of patched areas in a manner, which eliminates evidence of patching and refinishing. For continuous surfaces, extend refinish to nearest intersection, with a neat transition to adjacent surfaces.
- D. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.
  - 1. Completely fill holes and depressions in existing masonry walls that are to remain with an approved masonry patching material applied according to manufacturer's written recommendations.
- E. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- F. Floors and Walls: Where walls or partitions that are demolished 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 existing floor coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
  - 1. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections of these Specifications.
  - 2. Where patching occurs in a painted surface, apply primer and intermediate paint coats over patch and apply final paint coat over entire unbroken surface containing patch. Provide additional coats until patch blends with adjacent surfaces.
  - 3. Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
- G. Ceilings: Patch, repair, or rehang existing ceilings to remain as necessary to provide an even-plane surface of uniform appearance where access is required to do the work and a new ceiling is not scheduled.

### 3.8 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

### 3.9 CLEANING

- A. Sweep the building broom clean on completion of selective demolition operation.
- B. Change filters on air-handling equipment exposed to demolition operations on completion of selective demolition operation.

END OF SECTION 024119

## SECTION 033000 - CAST-IN-PLACE CONCRETE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, placement procedures, and finishes.
- B. Related Sections include the following:
  - 1. Division 5 Section "Metal Fabrications" for coordination with steel pipe railings.

#### 1.3 SUBMITTALS

- A. Steel Reinforcement Shop Drawings: Details of fabrication, bending, and placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material, grade, bar schedules, stirrup spacing, bent bar diagrams, arrangement, and supports of concrete reinforcement.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed concrete Work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
- C. ACI Publications: Comply with the following, unless more stringent provisions are indicated:
  - 1. ACI 301, "Specification for Structural Concrete."
  - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

### PART 2 - PRODUCTS

#### 2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
  - 1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, B-B (Concrete Form), Class 1, or better, mill oiled and edge sealed.
- B. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
  - C. Form-Release Agent: Commercially formulated form-release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
    1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
  - D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
    1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of the exposed concrete surface.
    2. Furnish ties that, when removed, will leave holes not larger than 1 inch (25 mm) in diameter in concrete surface.

## 2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 82, as drawn.
- C. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

## 2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type II.
- B. Normal-Weight Aggregate: ASTM C 33, uniformly graded, and as follows:
  1. Fine Aggregate: Sand shall consist of hard, tough and preferably siliceous material, clean, free from mineral or other coatings, soft particles, clay, loam or other deleterious matter.
  2. Coarse Aggregate: Crushed stone or gravel, having clean, hard, durable, uncoated particles, free from deleterious matter. The 3/4" aggregate shall conform to gradation size #67 in Table II of ASTM C-33. 3/4" (19 mm) aggregate shall be the minimum permissible size used, unless required for structural clearances between reinforcing bars or between bars and the forms require smaller aggregate size. Clearances requiring smaller aggregate size shall be submitted to the Architect for verification and approval
- C. Water: Potable and complying with ASTM C 94.

## 2.4 ADMIXTURES

- A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride.
- B. Air-Entraining Admixture: ASTM C 260.

- C. Mid-Range, Water-Reducing Admixture: ASTM C 494, Type A.
- D. High-Range, Water-Reducing Admixture: ASTM C 494, Type F or G.

## 2.5 FLOOR AND SLAB TREATMENTS

- A. Exterior Sealer: ProSoCo, Inc. Consolideck Saltguard.

## 2.6 CURING MATERIALS

- A. Moisture-Retaining Cover: One of the following as specified under concrete protection, sealers and curing.
  - 1. Waterproof paper, complying with ASTM C 171.
  - 2. Opaque white polyethylene film.

## 2.7 RELATED MATERIALS

- A. Isolation Joint: 2 pound minimum density closed cell polyethylene with 3/8" deep top strip off to allow installation of joint sealant; 3/8 inch thickness by full depth of slab.
- B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
  - 1. Available Products:
    - a. Day-Chem Ad Bond, Dayton Superior Corp.
    - b. SBR Latex, Euclid Chemical Co.
    - c. Daraweld C, W.R. Grace & Co.
    - d. Hornweld, A.C. Horn, Inc.
    - e. Everbond, L&M Construction Chemicals, Inc.
    - f. Acryl-Set, Master Builders Inc.
- C. Vapor Retarder: 10 mil virgin polyethylene.
- D. Non-Shrink Grout: "Euco N-S" by the Euclid Chemical Company; "Master-Flow 928" (non-metallic) by Master Builders, Five Star Grout, Dayton Superior Sure Grip Grout, or Sika Grout 212. The grout shall conform to CRD C-621, type b or d.

## 2.8 CONCRETE MIXES

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, according to ACI 211.1 and ACI 301.
- B. Footings and Foundation Walls: Proportion normal-weight concrete mix as follows:
  - 1. Compressive Strength (28 Days): 3000 psi.
  - 2. Water-Cement Ratio: 0.50 maximum (air-entrained).
- C. Interior Concrete: Low water content concrete mix as follows:
  - 1. Compressive Strength (28 Days): 3500 psi.
  - 2. Water-Cement Ratio: 0.52 maximum (non-air-entrained).
  - 3. Course Aggregate Size: 3/4 inch.
- D. Exterior Slabs, Pads, and Ramps: Proportion normal-weight concrete mix as follows:

1. Compressive Strength (28 Days): 4500 psi.
  2. Water-Cement Ratio: 0.42 maximum, air-entrained.
- E. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
1. Ramps and sloping surfaces: 3-1/2 inches maximum.
  2. Slabs: 5-inches  $\pm$ 1-inch.
  3. Reinforced foundation systems: Not less than 2 inch(50 mm) minimum and not more than 5.5 inches maximum.
- F. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant, as accepted by Architect. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Architect before using in Work.
- G. Air Content: Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content as follows within a tolerance of plus 1 or minus 1.5 percent, unless otherwise indicated:
1. Air Content: 5.5 percent for 1-1/2-inch- (38-mm-) nominal maximum aggregate size.
  2. Air Content: 6 percent for 3/4-inch- (19-mm-) nominal maximum aggregate size.
- H. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use mid-range water-reducing admixture for all concrete. Add admixture at manufacturer's prescribed rate. Dosage shall not exceed 8 ounces per 100 pounds of cement.

## 2.9 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

## 2.10 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94 and ASTM C 1116, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. When air temperature has fallen to or is expected to fall between 40 deg F and 30 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 60 deg F and not more than 80 deg F at point of placement. When air temperature has fallen to or is expected to fall below 30 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 65 deg F and not more than 80 deg F at point of placement.
1. Do not use frozen materials or materials containing ice or snow.
  2. Do not use calcium chloride, salt, or other materials containing antifreeze agents.
- C. When Hot Weather Conditions Cause Concrete Temperatures to Exceed 90 deg F Perform the Following Procedures:
1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 deg F. Mixing water may be chilled or chopped ice may be used to control



- temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Use retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Architect.

## PART 3 - EXECUTION

### 3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 limits and as follows:
  1. Surfaces exposed to view: Class A tolerance, checked with 5 foot template, except gradual irregularities not to exceed 1/4 inch and abrupt surface irregularities not to exceed 1/8 inch (3 mm).
  2. Other concrete surfaces: Provide Class C tolerances checked with 5 foot template, with gradual irregularities not to exceed 1/2 inch and abrupt surface irregularities not to exceed 1/4 inch.
  3. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet, nor 3/4 inch in 40 feet or more.
  4. Variation of Cross-Sectional Dimension (thickness): 12 inch dimension or less, do not exceed 3/8 inch greater nor 1/4 inch less than indicated. 12 inch dimension but not over 3 foot dimension, do not exceed 1/2 inch greater nor 3/8 inch less than indicated.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
  1. Do not use rust-stained steel form-facing material.
- F. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- G. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- H. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

### 3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices, reinforcing and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete.

### 3.3 VAPOR RETARDERS

- A. Vapor Retarder: Granular base shall be level and properly rolled or tamped, ready to receive vapor barrier. Place retarder over aggregate in largest practical sizes to have as few joints as possible. Laps shall be a minimum of 3 inches and in direction of pour. Seal joints with continuous strips of 2 inch wide tape. Take care not to unnecessarily puncture retarder. Lap retarder up wall to top of the slab and seal to wall in conjunction with isolation joint system.

### 3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
  - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire. Support welded wire fabric with continuous mesh supports, spaced to hold welded wire fabric in proper position.

### 3.5 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
  - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Dowel Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated. Space dowels 16 inches on center unless indicated otherwise, with proper projection to facilitate full coverage of dowel by the dowel sleeve. Dowels shall be level and square to the slab edge with the center line of the dowel at the center line of the slab thickness.

### 3.6 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Before placing concrete, water may be added at Project site, subject to limitations of ACI 301.
  - 1. Do not add water to concrete after adding high-range water-reducing admixtures to mix.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot

be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

- D. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.
  - 1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.
  - 2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
  - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  - 2. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
  - 3. Slope surfaces uniformly to drains where required.
  - 4. Maintain reinforcing in proper position on chairs during concrete placement. Do not puncture vapor retarder materials.
- F. Placing Exterior Concrete Walks, Ramps and Flatwork: Place concrete, screed and wood float surfaces to a smooth and uniform finish, free of open texturing and exposed aggregate. Avoid working mortar to surface.
  - 1. Bull float directly behind screed before bleedwater appears.
  - 2. Immediately behind bullfloat, drag broom across surface for a medium broom finish. If bleedwater appears before application of broom finish, allow surface water to evaporate before brooming.

### 3.7 FINISHING FORMED SURFACES

- A. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch (3 mm) in height.

### 3.8 FINISHING FLOORS AND SLABS

- A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots.

Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.

1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, when surface water has disappeared, and when concrete has stiffened sufficiently. Cut down high spots and fill low spots, using a straightedge as required to meet the floor flatness and levelness tolerances. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
  2. Apply float finish to surfaces indicated, to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first trowel finish and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
1. Apply a trowel finish to all slab surfaces.
  2. Finish surfaces to match existing.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

### 3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.
- B. Non-Shrink Grout: Grout steel billet bearing plates, column base plates, equipment bases, and other locations noted in the Structural Drawings with non-shrink grout.

### 3.10 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with recommendations in ACI 305R for hot-weather protection during curing.
- B. Formed Surfaces: Cure formed concrete surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing by the following method:
1. Moisture Cure Methods: Spray mist with water and cover with moisture retaining cover.
- C. Interior Slab Surfaces: Begin curing immediately after finishing concrete. Cure floor slab by the following method:
1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining waterproof paper or polyethylene for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for seven days. Weight down and maintain in intimate contact with the slab for the duration of the curing period. Immediately repair any holes or tears during curing period using cover material and waterproof tape.

- D. Exterior Slab Surfaces: Begin curing immediately after finishing concrete. Cure exterior slabs by the following method:
  - 1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining waterproof paper or white polyethylene for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Weight down and maintain in intimate contact with the slab for the duration of the curing period. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- E. Exterior Sealer: Allow concrete to cure 28 days minimum. Coat clean, dry exterior slabs with water repellent sealer at the rate of 50 to 75 sq. ft./gal. Concrete surface temperature shall be between 50° and 100°F.

### 3.11 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

### 3.12 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Sampling and testing for quality control may include those specified in this Article.
- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd.
  - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
    - a. When total quantity of a given class of concrete is less than 50 cu. yd., Architect may waive strength testing if adequate evidence of satisfactory strength is provided.
  - 3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  - 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
  - 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
  - 6. Compression Test Specimens: ASTM C 31; cast and laboratory cure one set of four standard cylinder specimens for each composite sample.
    - a. Properly store cylinders while awaiting transport to laboratory, maintaining temperature between 60 deg F and 80 deg F. Deliver to laboratory for curing within 24 hours of casting test specimen.
  - 7. Compressive-Strength Tests: ASTM C 39; test one specimen at 7 days, one specimen at 14 days, and two specimens at 28 days.
- C. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project

identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for 7-14- and 28-day tests.

- D. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.

END OF SECTION 033000

## SECTION 039300 - CONCRETE SLAB REHABILITATION

### 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 the following:
  - 1. Leveling concrete slab substrates below floor coverings that require a self leveling underlayment.
- B. Related Sections:
  - 1. Division 09 Sections “Resilient Flooring” for trowel skim coating over existing adhesive surfaces and trowel leveling of surface irregularities.

#### 1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain each of the following through one source from a single manufacturer:
  - 1. Concrete patching and rebuilding materials.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in manufacturer's original and unopened containers and labeled with type and name of products and manufacturers.
- B. Comply with manufacturer's written instructions for minimum and maximum temperature requirements and other conditions for storage.
- C. Store cementitious materials off the ground, under cover, and in a dry location.
- D. Store aggregates covered and in a dry location where grading and other required characteristics can be maintained and contamination avoided.

#### 1.5 PROJECT/SITE CONDITIONS

- A. Environmental Limitations for Epoxies: Do not apply when air and substrate temperatures are outside limits permitted by manufacturer. During hot weather, cool epoxy components before mixing, store mixed products in shade, and cool unused mixed products to retard setting. Do not apply to wet substrates unless approved by manufacturer.
- B. Cold-Weather Requirements for Cementitious Materials: Do not apply unless air temperature is between 40 and 90 deg F and will remain so for at least 48 hours after completion of Work.

- C. Hot Weather Requirements for Cementitious Materials: Protect repair work when temperature and humidity conditions produce excessive evaporation of water from patching materials. Provide artificial shade and wind breaks, and use cooled materials as required. Do not apply to substrates with temperatures of 90 degrees F and above.

## PART 2 – PRODUCTS

### 2.1 MATERIALS – CONCRETE SLAB RESTORATION

- A. Leveling 1-1/2 inch to 1/8 inch thick – Beneath Floor Covering Requiring Full Coverage Leveling: Subject to compliance with requirements, products that may be incorporated into the Work:
1. Ardex, Inc.; K-15 Self-Leveling Underlayment Concrete.
    - a. Primer: product as required for substrate.
- B. Patching Material 3 inch thick to 1/4 inch - Beneath floor covering: Subject to compliance with requirements, polymer modified, cement based, fast setting, trowelable repair products that may be incorporated into the Work:
1. ARDEX, Inc.: SD-P.
- C. Replacement of floor slab over trenches where floor slab, up to 5 inches thick maximum, has been removed and needs to be replaced within a short time:
1. First lift: 3 ½ inch minimum thickness to bring top of trench fill to within ¼ to ½ inch below surrounding finished slab elevation
    - a. ARDEX Inc. K-15, mix with 3/8 inch aggregate per manufacturer's recommendations.
    - b. Mapei: Nova / Plan 5, mix with 3/8 inch aggregate per manufacturer's recommendations.
    - c. TEC Specialty Products, TA-323 EZ Level, mix with 3/8 aggregate per manufacturer's recommendations.
  2. Second Lift: Finish area flush with slab with leveling or patching material specified above.
- D. Replacement of floor slab over trenches where floor slab has been completely removed and schedule allows specified cure period for concrete and drying time to permit floor covering installation.
1. First lift: Portland cement concrete as specified in Section 033000 to bring trench fill to within 1/4 to 1/2 inch of surrounding slab elevation.
  2. Second Lift: Finish area flush with slab with leveling or patching material specified above.
- E. Coarse Aggregate for Adding to Patching Mortar and Leveling Material – Deep Applications: Washed aggregate complying with ASTM C 33, Size No. 8, Class 5S. Add only as recommended by patching mortar manufacturer.



## PART 3 – EXECUTION

### 3.1 EXAMINATION

- A. Mark areas for removal by straightening and squaring off boundaries of areas to receive patching mortar.
- B. Verify that concrete slabs are dry and free of curing compounds, sealers, hardeners, and other materials that would interfere with bonding of leveling and patching material. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.
- C. Report conditions outside of parameters recommended by manufacturer and other unacceptable conditions. Do not proceed with installation until unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Prepare surface to receive patching and leveling materials in accordance with Manufacturer's written requirements.
- B. Mix materials in accordance with manufacturer's written instructions. Measure materials using buckets or other suitable measuring container.

### 3.3 INSTALLATION

- A. Patching Material Use for deep cavities and where indicated. Place according to manufacturer's written instructions and as follows:
  - 1. Slab Patching – Beneath Floor Covering: Prime surface per manufacturer's directions. Force material against edge of repair, working toward center. After filling, consolidate, then screed. Allow material to set to desired stiffness, and trowel smooth.
- B. Self-Leveling: Use for uneven floor slabs with defects and irregularities requiring a self-leveling material to prevent telegraphing through floor coverings. Place according to manufacturer's written instructions and as follows:
  - 1. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
  - 2. Apply underlayment to produce uniform, level surface. Feather edges to match adjacent floor elevations.
  - 3. For self-leveling material to be left exposed, prepare, apply, and finish penetrating liquid floor treatment according to penetrating sealer manufacturer's written instructions to clean surface.
- C. Trench Patching: Place floor slab trench patching material in continuous operation over vapor retarder specified in Section 072300 - Under-Slab Vapor Retarders. Finish surface of patch flush with slab surface that prevents telegraphing of patch through floor covering.

END OF SECTION 039300

## SECTION 055000 - METAL FABRICATIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes, but is not limited to, the following:
  - 1. Steel pipe railings and handrails.
  - 2. Low partition tube steel supports.
- B. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete" for installing items indicated to be cast into concrete.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Railings: Provide railings capable of withstanding the effects of gravity loads, IBC 2006 requirements, and the following loads and stresses within limits and under conditions indicated:
  - 1. Handrails:
    - a. Uniform load of **50 lbf/ ft.** applied in any direction.
    - b. Concentrated load of **200 lbf** applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 2. Top Rails of Guards:
    - a. Uniform load of 50 lbf/ ft. applied in any direction.
    - b. Concentrated load of **200 lbf** applied in any direction.
    - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - 3. Infill of Guards:
    - a. Concentrated load of 50 lbf applied horizontally on an area of **1 sq. ft.**
    - b. Uniform load of **25 lbf/ ft.** applied horizontally.
    - c. Infill load and other loads need not be assumed to act concurrently.
- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. 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.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Section 013300.
- B. Product Data: For the following:
  - 1. Metal railing panels.

- C. Shop Drawings: Show fabrication and installation details for stairs, railings, infill system, guardrails and metal fabrications.
  - 1. Include plans, elevations, sections, and details of railings, infill system, guardrails and metal fabrications and their connections. Show anchorage and accessory items.
  - 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

## 1.5 QUALITY ASSURANCE

- A. Fabricator Qualifications: Firm experienced in producing metal fabrications similar to those indicated for this Project with a record of successful in-service performance, and with sufficient production capacity to produce required units without delaying the Work.
- B. Professional Engineer Qualifications: Professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for design of concrete filled steel pan stairs 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."
  - 3. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone re-certification.

## 1.6 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.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications

## PART 2 - PRODUCTS

### 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
  - 1. Galvanized finish for exterior installations and where indicated.
- B. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
  - 1. Galvanized finish for exterior installations and where indicated.
- C. Metal Plank Grating and Stair Treads: Grip Strut Stair Treads and Grating Planks, GS Metals Corp. serrated surface, ASTM A525 (G-90) galvanized steel.
- D. Metal Railing Panels: Miller Wire Works or equal, 1-1/2 inch 10 gage diamond mesh, intermediate crimped; panels with perimeter U channels and flat bar attachment tabs.
  - 1. Hot dipped galvanized finish.

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Machine Screws: ASME B18.6.3.
- F. Lag Bolts: ASME B18.2.1.
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1.
- I. Lock Washers: Helical, spring type, ASME B18.21.1.
- J. 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.

- K. 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. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.
- L. Toggle Bolts: FS FF-B-588, tumble-wing type, class and style as required.
- M. Chemical Anchors: Two-part epoxy systems with impacted bolt, rod or anchor as follows:
  - 1. Concrete Anchor: Epoxy capsule system similar to Hilti HVA Adhesive Anchor System, Ramset Chemset anchor system, or approved equal.
  - 2. Masonry Anchor: Epoxy injection system similar to Hilti HIT C-100 System.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- C. 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.
  - 1. Products:
    - a. Sure-grip High Performance Grout; Dayton Superior Corp.
    - b. Euco N-S Grout; Euclid Chemical Co.
    - c. Five Star Grout; Five Star Products.
    - d. Crystex; L & M Construction Chemicals, Inc.
    - e. Masterflow 928 and 713; Master Builders Technologies, Inc.
    - f. Sealtight 588 Grout; W. R. Meadows, Inc.
    - g. SonogROUT 14; Sonneborn Building Products - ChemRex, Inc.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Form metal fabrications from materials of size, thickness, and shapes indicated but not less than needed to comply with performance requirements indicated. Work to dimensions indicated or accepted on Shop Drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of each metal fabrication.
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately **1/32 inch**, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- F. 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.
- G. 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.
- H. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- I. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- J. 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. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.6 STEEL PIPE RAILINGS AND HANDRAILS

- A. General: Fabricate steel pipe railings and handrails to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of tube, post spacings, and anchorage, but not less than that needed to withstand indicated loads.
  - 1. Steel Pipe Railings and Handrail Configuration: Fabricate to detail.
- B. Welded Connections: Fabricate railings with welded connections. Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings. All exposed welds shall be ground smooth.
- C. Form changes in direction of railings by use of prefabricated elbow fittings and radius bends.
- D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

- E. Close exposed ends of railing members by welding 3/16-inch thick steel plate in place or by use of prefabricated fittings.
- F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated.
- G. For railing posts set in concrete provide sleeves of galvanized steel pipe not less than 6" long and with an inside diameter not less than 1/2-inch greater than the outside diameter of pipe. Provide steel plate closure welded to bottom of sleeve and of width and length not less than 1-inch greater than outside diameter of sleeve.
  - 1. Provide friction fit, removable covers designed to keep sleeves clean and hold top edge of sleeve 1/2-inch below finished-surface of concrete.
- H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
- I. Provide galvanized finish for all exterior steel railings and infill, including pipe, bars fittings, brackets, fasteners, and other ferrous components.

## 2.7 LOW PARTITION TUBE STEEL SUPPORTS

- A. General: Provide steel framing supports for low partitions as indicate on drawings.
- 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.

## 2.8 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.
- C. Galvanize exterior miscellaneous steel trim and interior miscellaneous steel trim, where indicated.

## 2.9 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.

## 2.10 STEEL AND IRON FINISHES

- A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dip process, 0.05 - 0.09% nickel content, Deltagalv by Duncan Galvanizing, or approved equal. Provide thickness of galvanizing specified in referenced standards. Hot-dip galvanize items as indicated to comply with applicable standard listed below:
  - 1. ASTM A 123/A 123M, for galvanizing both fabricated and unfabricated steel and iron products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick or thicker.
  - 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installing anchorages, including concrete inserts, sleeves, anchor bolts, and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.
- B. Set sleeves in concrete with tops flush with finish surface elevations. Protect sleeves from water and concrete entry.

### 3.2 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 intended 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.



### 3.3 INSTALLING RAILINGS AND HANDRAILS

- A. Adjust railing systems before anchoring to ensure matching alignment at abutting joints. Space posts at spacing indicated or, if not indicated, as required by design loads. Plumb posts in each direction. Secure posts and rail ends to building construction.
- B. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch clearance from inside face of handrail and finished wall surface. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads. Secure wall brackets to building construction as follows:
  - 1. For concrete anchorage, use drilled-in expansion shields and hanger or lag bolts.

### 3.4 SETTING LOOSE PLATES

- A. Clean bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of bearing plates.
- B. Set loose leveling and bearing plates on wedges or other adjustable devices. After the bearing members have been positioned and plumbed, tighten the anchor bolts. Do not remove wedges or shims, but if protruding, cut off flush with the edge of the bearing plate before packing with grout.
  - 1. Use nonshrink, metallic grout in concealed locations where not exposed to moisture; use nonshrink, nonmetallic grout in exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.5 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.
- B. Anchor supports for operable partitions securely to and rigidly brace from building structure.

### 3.6 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

## SECTION 061000 - ROUGH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOUCMENTS

- 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 the following:
  - 1. Framing with dimension lumber.
  - 2. Rooftop equipment bases and support curbs.
  - 3. Wood blocking and nailers.
  - 4. Sheathing.
  - 5. Plywood backing panels.
  - 6. Building wrap.
  - 7. Flexible flashing at openings in sheathing.
- B. Products installed, but not furnished, under this Section include the following:
  - 1. Division 07 Section "Building Insulation"

#### 1.3 DEFINITIONS

- A. Rough Carpentry: Carpentry work not specified in other Sections and not exposed, unless otherwise indicated.
- B. Dimension Lumber: Lumber of **2 inches nominal** or greater but less than **5 inches nominal** in least dimension.
- C. Lumber grading agencies, and the abbreviations used to reference them, include the following:
  - 1. NLGA - National Lumber Grades Authority.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
- C. Research/Evaluation Reports: For the following, showing compliance with building code in effect for Project:
  - 1. Metal framing anchors.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover and dry. Protect against exposure to weather and contact with damp or wet surfaces. Stack plywood and other panels flat. Place spacers between each bundle of lumber, plywood, and panel products to provide air circulation. Provide for air circulation around stacks and under coverings.

## 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.

### 2.2 WOOD AND PANEL PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
  - 1. Factory mark each piece of lumber with grade stamp of grading agency.
  - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
  - 3. Provide dressed lumber, S4S, unless otherwise indicated.
  - 4. Provide dry lumber with 19 percent maximum moisture content at time of dressing for **2-inch nominal** thickness or less, unless otherwise indicated.
- B. Wood Structural Panels:
  - 1. Plywood: DOC PS 1.
  - 2. Thickness: As needed to comply with requirements specified but not less than thickness indicated.
  - 3. Factory mark panels according to indicated standard.

### 2.3 DIMENSION LUMBER FRAMING

- A. General: Provide dimension lumber of grades indicated according to the American Lumber Standards Committee National Grading Rule provisions of the grading agency indicated.
- B. Maximum Moisture Content: 19 percent.
- C. Ceiling Joists (Non-Load-Bearing): No. 2 or better grade and the following species:
  - 1. Spruce-pine-fir; NLGA.
- D. Joists, Rafters, and Other Framing Not Listed Above: No. 2 or better grade and the following species:
  - 1. Spruce-pine-fir; NLGA.

### 2.4 MISCELLANEOUS LUMBER

- A. General: Provide lumber for support or attachment of other construction, including the following:
  - 1. Blocking.
  - 2. Nailers.

3. Rooftop equipment bases and support curbs.
- B. For items of dimension lumber size, provide Construction, Stud, or No. 2 grade lumber with 19 percent maximum moisture content and the following species:
  1. Spruce-pine-fir; NLGA.
- C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

## 2.5 WALL SHEATHING

- A. Plywood Wall Sheathing: Exposure 1, Structural I sheathing.
  1. Span Rating: Not less than 32/16.
  2. Nominal Thickness: Not less than **5/8 inch**, except as otherwise noted.
  3. Species: Fir.

## 2.6 ROOF SHEATHING

- A. Plywood Roof Sheathing: Exposure 1, Structural I sheathing.
  1. Span Rating: Not less than 40/20.
  2. Nominal Thickness: Not less than **5/8 inch**.

## 2.7 PLYWOOD BACKING PANELS

- A. Telephone and Electrical Equipment Backing Panels: DOC PS 1, Exposure 1, C-D Plugged, fire-retardant treated, in thickness indicated or, if not indicated, not less than **1/2 inch** nominal thickness.

## 2.8 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
  1. Where rough carpentry is exposed to weather, in ground contact, in roof area, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
  2. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
  3. Where preservative-treated lumber or plywood is used, provide stainless steel fasteners.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: **ASME B18.2.1**.
- F. Bolts: Steel bolts complying with **ASTM A 307, Grade A**; with **ASTM A 563** hex nuts and, where indicated, flat washers.
- G. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to 6 times the load imposed when installed in

unit masonry assemblies and equal to 4 times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B 633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with **ASTM F 593 and ASTM F 594, Alloy Group 1 or 2.**

## 2.9 METAL FRAMING ANCHORS

- A. Manufacturer: Simpson Strong-Tie Co., Inc.
- B. Galvanized Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, **G60** coating designation.
  1. Use for interior locations where stainless steel is not indicated.
- C. Rafter Tie-Downs (Hurricane Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, **2-1/4 inches** wide by **0.062 inch** thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

## 2.10 WEATHER-RESISTANT SHEATHING PAPER

- A. Weather Barrier: Water-vapor-permeable, consisting of multiple layers of UV stabilized spun-bonded polypropylene.
  1. Surface Burning Characteristics: ASTM E 84; Flame-spread index, less than 25; Smoke-developed index, less than 450.
  2. Water Vapor Permeance: ASTM E 96 Method B, 200 perms, minimum.
  3. Water Resistance: AATCC 127, 550 mm hydrostatic head for 5 hours, no leakage.
  4. Tensile Strength: ASTM D 882; 25 lbf/inch, machine direction; 20 lbf/inch, cross-machine direction.
  5. Allowable UV Exposure Time: 270 days.
  6. Thickness: 0.020 inches.
  7. Weight: 5 oz per sq. yd.
  8. Product: WallShield; VaproShield L.L.C., phone: (866) 731-7663. Asphalt felt is not acceptable.
- B. Weather Barrier with Drainage Matrix (Fabric): Air and water-resistive barrier and rain screen drainage matrix, water-vapor-permeable, consisting of multiple layers of UV-stabilized spun-bonded polypropylene.
  1. Water Vapor Permeance: ASTM E 96 Method B, 50 perms minimum.
  2. Water Resistance: AATCC 127, 550 mm hydrostatic head for 5 hours: No leakage.
  3. Air Permeance: ASTM E 2178, 0.0019 cfm/sq. ft.
  4. Air Leakage: ASTM E 283, 0.000034 cfm/sq. ft.
  5. Tensile Strength: ASTM D 882, 44.8 lbf/inch, machine direction; 25 lbf/inch, cross-machine direction.
  6. Allowable UV Exposure Time: 270 days.
  7. Width: 44 inch.
  8. Membrane Thickness: 0.020 inches.
  9. Weight: 5 oz per sq. yd..
  10. Color: Black.
  11. Drainage Matrix:
    - a. Thickness: 0.26 inch.
    - b. Thickness: 0.26 inch.
  12. Product: WrapShield HS; VaproShield L.L.C., phone: (866) 731-7663. Asphalt felt is not acceptable.

- C. Weather Barrier Accessories: Provide the following for use with building wrap:
  - 1. Single-Sided Tape: 20 mil by 3-inch wide lap and edge tape.
  - 2. Double-Sided Tape: 30 mil by 1-inch wide lap tape.
  - 3. Butyl Rubber Tape: As recommended by building wrap manufacturer and approved by Architect.
- D. Fasteners: Manufacturer's recommended corrosion-resistant, cap-headed stainless steel nails, staples, or screws used in conjunction with manufacturer's spray adhesive, as appropriate for substrate.

## 2.11 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- B. Framing Standard: Comply with AF&PA's "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- C. Install framing members of size and spacing indicated.
- D. Metal Framing Anchors: Install metal framing to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports, unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
- G. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- H. Do not use panel materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- I. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction, unless otherwise indicated.
- J. Securely attach rough carpentry and panel work to substrate by anchoring and fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.

3. Published requirements of metal framing anchor manufacturer.
  4. National Evaluation Report No. NER-272 for pneumatic or mechanical driven staples, P-Nails, and allied fasteners.
- K. Use common wire nails, unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
1. Use hot-dip galvanized or stainless steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
  2. Use stainless steel fasteners for fastening pressure preservative treated materials.
- L. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- M. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 WOOD BLOCKING AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Install wood blocking and nailers to support construction and fixtures, including, but not limited to, equipment services, heavy trim, grab bars, toilet accessories, casework, furnishings, window treatment, handrail brackets, shelving, building specialties, clothes rods, window sills, drywall window return shims, countertop supports, wall panels, tack boards and marker boards, Owner furnished items, and miscellaneous items and construction. Provide **3/4-inch** thick plywood covering a minimum of 32 inches square for toilet accessories. Provide **1-1/2 inch** thick blocking minimum, for grab bars, door stops and handrail supports. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
1. Provide concealed wood blocking behind gypsum wallboard where door stops are to be installed.
  2. Install blocking for grab bars and handrail supports to withstand a downward load of at least **250 lbf**, when tested according to method in ASTM F 446.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

### 3.3 RAFTER FRAMING INSTALLATION

- A. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.
- B. Provide special framing as indicated for eaves, overhangs, and similar conditions, if any.

### 3.4 WOOD STRUCTURAL PANEL INSTALLATION

- A. General: Comply with applicable recommendations contained in APA Form No. E30K, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.
- B. Fastening Methods: Fasten panels as indicated below:
  - 1. Wall and Roof Sheathing:
    - a. Nail to wood framing.
    - b. Space panels **1/8 inch** apart at edges and ends.
  - 2. Plywood Backing Panels: Nail or screw to supports.

### 3.5 WEATHER-RESISTANT SHEATHING-PAPER INSTALLATION

- A. General: Comply with weather barrier manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
- B. Installation of Weather Barrier and with Weather Barrier Drainage Matrix: Install weather barrier starting from low to high in shingle fashion to shed water, overlapping edges 6 inches minimum and ends 6 inches. Attach with non-corrosive fasteners to hold in place. Seal end and side laps with seam tape. Lap weather barrier over metal flashings and seal with continuous double-sided seam tape to form a watertight barrier. Materials shall not be left exposed for longer than 8 months. Seal top, bottom, and edge termination, setting weather barrier in bead of sealant.



## SECTION 062000 - FINISH CARPENTRY

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior standing and running trim.
  - 2. Exterior lumber siding.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view.
  - 2. Division 06 Section "Architectural Woodwork" for shop-fabricated interior woodwork.
  - 3. Division 09 Section "Painting" for priming and backpriming of finish carpentry.

#### 1.3 DEFINITIONS

- A. Inspection agencies, and the abbreviations used to reference them, include the following:
  - 1. NELMA - Northeastern Lumber Manufacturers Association.
  - 2. NLGA - National Lumber Grades Authority.
  - 3. WCLIB - West Coast Lumber Inspection Bureau.
  - 4. WWPA - Western Wood Products Association.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of process and factory-fabricated product. Include construction and application details, component material descriptions, dimensions of individual components and profiles, textures, and colors.
  - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used, net amount of preservative retained. Include chemical treatment manufacturer's written instructions for handling, storing, installing, and finishing treated material.
  - 2. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Keep materials under cover, off ground, and dry. Protect materials against weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Provide for air circulation within and around stacks and under temporary coverings.

- B. Deliver interior finish carpentry only when environmental conditions meet requirements specified for installation areas. If interior finish carpentry must be stored in other than installation areas, store only where environmental conditions meet requirements specified for installation areas.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations for Interior Work: Do not deliver or install interior finish carpentry until building is enclosed and weatherproof, wet work in space is completed and nominally dry, and provisions are made to maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.
- B. Weather Limitations for Exterior Work: Proceed with installation only when existing and forecasted weather conditions permit work to be performed and at least one coat of specified finish to be applied without exposure to rain, snow, or dampness.
  - 1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.
- C. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 - PRODUCTS

### 2.1 MATERIALS, GENERAL

- A. Lumber: DOC PS 20 and applicable grading rules of inspection agencies certified by the American Lumber Standards' Committee Board of Review.
  - 1. Factory mark each piece of lumber with grade stamp of inspection agency indicating grade, species, moisture content at time of surfacing, and mill.
  - 2. For exposed lumber, mark grade stamp on end or back of each piece.

### 2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process:
  - 1. Lumber: AWPA C2. Kiln dry after treatment to a maximum moisture content of 19 percent.
  - 2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
  - 3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
  - 4. Do not use material that is warped or does not comply with requirements for untreated material.
  - 5. Mark lumber with treatment quality mark of an inspection agency approved by ALSC's Board of Review.
    - a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.
7. Application: Where indicated.

### 2.3 EXTERIOR STANDING AND RUNNING TRIM

- A. Lumber Trim for Painted Finish: Kiln-dried, lumber with surfaced (smooth) face and of the following species and grade:
  1. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; Finish or 1 Common (Colonial); NeLMA, NLGA, WCLIB, or WWPA.
  2. Maximum Moisture Content: 15 percent.
  3. Finger Jointing: Not allowed.
- B. Cellular PVC Trim: Extruded, expanded PVC with a small-cell microstructure, made from UV- and heat-stabilized, rigid material.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Ply-Trim, Inc.; DuraBoard.
    - b. Royal Mouldings Limited; Pro Series Exterior Mouldings.
    - c. Vycom Corp.; Azek.
  2. Density: Not less than 31 lb/cu. ft..
  3. Heat Deflection Temperature: Not less than 130 deg F, per ASTM D 648.
  4. Coefficient of Thermal Expansion: Not more than  $4.5 \times 10^{-5}$  inches/inch x deg F.
  5. Water Absorption: Not more than 1 percent, per ASTM D 570.
  6. Flame-Spread Index: 75 or less, per ASTM E 84.

### 2.4 SIDING

- A. Lumber Siding: Kiln-dried lumber siding complying with DOC PS 20.
  1. Species and Grade: Grade Finish or 1 Common (Colonial) eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods; NELMA, NLGA, WCLIB, or WWPA.
  2. Bevel Siding: S1S2E, size to match existing, measured on the face and thick edge at 19 percent moisture content.
  - 3.

### 2.5 MISCELLANEOUS MATERIALS

- A. Fasteners for Exterior Finish Carpentry: Provide nails or screws of the following materials, in sufficient length to penetrate minimum of **1-1/2 inches** into substrate, unless otherwise recommended by manufacturer:
  1. For face-fastening siding, provide ringed-shank siding nails.
  2. For pressure-preservative-treated wood, provide stainless-steel fasteners.
  3. For applications not otherwise indicated, provide hot-dip galvanized steel fasteners.
- B. Exterior Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.
- C. Sealants: Comply with requirements in Division 07 Section "Joint Sealants" for materials required for sealing siding work.

### 2.6 FABRICATION

- A. Wood Moisture Content: Comply with requirements of specified inspection agencies and with manufacturer's written recommendations for moisture content of finish carpentry at relative humidity conditions existing during time of fabrication and in installation areas.
- B. Back out or kerf backs of the following members, except members with ends exposed in finished work:
  - 1. Exterior standing and running trim wider than 5 inches.
- C. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Clean substrates of projections and substances detrimental to application.
- B. Exterior Finish Carpentry: Prime lumber to be painted, including both faces and edges. Cut to required lengths and prime ends. Comply with requirements in Division 09 Section "Painting."

### 3.3 INSTALLATION, GENERAL

- A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.
  - 1. Do not use manufactured units with defective surfaces, sizes, or patterns.
- B. Install finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.
  - 1. Scribe and cut finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
  - 2. Countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.
  - 3. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
  - 4. Coordinate finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exposed surfaces of finish carpentry.
  - 5. Finish according to specified requirements.

### 3.4 EXTERIOR STANDING AND RUNNING WOOD TRIM INSTALLATION

- A. Install flat grain lumber with bark side exposed to weather.
- B. Install with minimum number of joints practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than **24 inches** long, except where necessary.
  - 1. Use scarf joints for end-to-end joints.
  - 2. Stagger end joints in adjacent and related members.
- C. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.
- D. Unless otherwise indicated, countersink fasteners, fill surface flush, and sand where face fastening is unavoidable.

### 3.5 STANDING AND RUNNING PVC TRIM INSTALLATION

- A. Install PVC trim in accordance with manufacturer's instructions and recommendations.
- B. Install with minimum number of joints practical, using full-length pieces from maximum lengths of material available. Do not use pieces less than **24 inches** long, except where necessary. Stagger joints in adjacent and related standing and running trim. Cope at returns and miter at corners to produce uniform joints throughout length of joint. End-to-end joints shall be ship-lapped and glued.
  - 1. Trim longer than **18 feet** shall be ship-lapped and installed with a **1/8-inch** gap in ship-lapped joint, allowing for expansion and contraction; fill joint with polyurethane base sealant (without silicone).
  - 2. Trim around door and window openings shall be glued at joining of horizontal and vertical components.
  - 3. Fit joints to exclude water.
- C. Fastening: Exterior trim shall be installed with stainless steel fasteners. Do not fasten trim within 3/8-inch of product edge. Prevent over-tightening or overdriving of fasteners. Fill fastener holes with polyurethane caulk; do not smear onto face.

### 3.6 SIDING INSTALLATION

- A. Install siding to comply with manufacturer's written instructions.
- B. Horizontal Lumber Siding: Apply starter strip along bottom edge of sheathing or sill. Install first course of siding with lower edge at least **1/8 inch** below starter strip and subsequent courses lapped **1 inch** over course below. Nail at each stud. Do not allow nails to penetrate more than one thickness of siding.

### 3.7 ADJUSTING

- A. Replace finish carpentry that is damaged or does not comply with requirements. Finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.8 CLEANING

- A. Clean finish carpentry on exposed and semiexposed surfaces.

3.9 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
  - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062000

## SECTION 064000 - ARCHITECTURAL WOODWORK

### 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 the following:
  - 1. Wood wall cap and window sills.
  - 2. Plastic-laminate countertops.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood blocking, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
  - 2. Division 09 Section "Painting" for field finishing of interior architectural woodwork.

#### 1.3 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated.
  - 1. For adhesives and sealants used inside the weatherproofing system, include a printed statement of the VOC content.
- C. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
  - 1. Show details full size.
  - 2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
  - 3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, and other items installed in architectural woodwork.
- D. Samples: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.
  - 1. Sample of fabricated trim, each 12 inches long.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of interior architectural woodwork.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards, Eight Edition" for grades of interior architectural woodwork, construction, finishes, and other requirements.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.
- B. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by accurate 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.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of blocking, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated. If a quality grade is not specified, provide AWI Custom Grade.
- B. Wood Species for Opaque Finish: Any closed-grain hardwood.
- C. High-Pressure Decorative Laminate, PL1& PL2: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
  - 1. Manufacturers: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
    - a. PL1: Formica Corporation.
    - b. PL2: Pionite; a division of Panolam Industries International Inc.
    - c. Formica Corporation.
    - d. Laminart.
    - e. Pioneer Plastics Corp.
    - f. Wilsonart International; Div. of Premark International, Inc.
  - 2. Colors, Patterns, and Finishes: As indicated on Materials Legend.
- D. Counter Bracket Supports: Fabricated of 6063 T-6, T-shaped extruded aluminum; MIG welded along 45 degree miters and along back; pre-punched for 1/4-inch fasteners; provide rubber grommet in 7/8-inch hole; powder coated finish; Rakks, Rangine Corp., Millis, MA.

### 2.2 INSTALLATION MATERIALS



- A. Screws: Select material, type, size, and finish required for each use and substrate. Comply with ASME B 18.6.1 for applicable requirements.
- B. Nails: Select material, type, size, and finish required for each use. Comply with FS FF-N-105 for applicable requirements.
- C. Epoxy Anchors: Red Head Umbrella Anchor, Model HBU-38, size as required for fasteners.
- D. VOC Limits for Installation Adhesives and Glues: Installation adhesives and glues used inside the weatherproofing system shall have the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Wood Glues: 30 g/L.
  - 2. Contact Adhesive: 250 g/L.

### 2.3 FABRICATION, GENERAL

- A. Interior Woodwork Grade: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and any additional requirements of this Section. When quality grade is not indicated, provide Custom quality grade.
- B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.
- C. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:
  - 1. Edges of Solid-Wood (Lumber) Members 3/4 Inch Thick or Less: 1/16 inch.
  - 2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 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.

### 2.4 INTERIOR WOOD WINDOW SILL (TRANSPARENT FINISH)

- A. Quality Standard: Comply with AWI Section 300.
- B. Grade: Premium.
- C. For trim items wider than available lumber, use veneered construction. Do not glue for width.
- D. For rails wider or thicker than available lumber, use veneered construction. Do not glue for width or thickness.

- E. 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.
- F. Assemble casings in plant except where limitations of access to place of installation require field assembly.
- G. Assemble moldings in plant to maximum extent possible. Miter corners in plant and prepare for field assembly with bolted fittings designed to pull connections together.
- H. Wood Species and Cut: Select white birch.
  - 1. Provide split species on trim that face areas with different wood species, matching each face of woodwork to species and cut of finish wood surfaces in areas finished.

## 2.5 WOOD WALL CAP (OPAQUE FINISH)

- A. Quality Standard: Comply with AWI Section 300.
- B. Grade: Custom.
- C. Wood Species: Any closed-grain hardwood.

## 2.6 SHOP FINISHING

- A. Quality Standard: Comply with AWI Section 1500, unless otherwise indicated.
  - 1. Grade: Provide finishes of same grades as items to be finished.
- B. General: Priming of interior architectural woodwork required to be performed at fabrication shop are specified in this Section. Refer to Division 09 Section "Painting" for final finishing of installed architectural woodwork and for material and application requirements for woodwork not specified to receive final finish in this Section.

# PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

## 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. 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.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners.

### 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.

### 3.4 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION 064000

## SECTION 072100 - BUILDING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Cavity wall insulation.
  - 2. Concealed building insulation (Roof Cavity Insulation).
- B. Related Sections include the following:
  - 1. Division 07 Section "Single-Ply Membrane Roof Patching" for insulation specified as part of roofing construction.
  - 2. Division 09 Section "Gypsum Board Assemblies" for provision of interior acoustical insulation in metal-framed assemblies.
  - 3. Division 21, 22 and 23 Sections insulation on pipes, ducts, and mechanical equipment.

#### 1.3 DEFINITIONS

- A. Thermal Resistivity: Where the thermal resistivity of insulation products are designated by "r-values," they represent the reciprocal of thermal conductivity (k-values). Thermal conductivity is the rate of heat flow through a homogenous material exactly 1 inch thick. Thermal resistivities are expressed by the temperature difference in degrees F between the two exposed faces required to cause one BTU to flow through one square foot per hour at mean temperatures indicated.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated.
- C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for insulation products.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below 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. Products: Subject to compliance with requirements, provide one of the products specified.

## 2.2 INSULATING MATERIALS

- A. General: Provide insulating materials that comply with requirements and with referenced standards.
  - 1. Preformed Units: Sizes to fit applications indicated; selected from manufacturer's standard thicknesses, widths, and lengths.
- B. Unfaced, Glass-Fiber Blanket (Batt) Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from inorganic glass bonded with thermosetting resin; with maximum flame-spread and smoke-developed indices of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.
  - 1. Full Depth of cavity. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.
  - 2. Insulation shall have the following minimum R-values:
    - a. Walls: R-21.
    - b. Roofs: R-19 batt insulation between joists with R-30 batt insulation laid perpendicular to batt insulation between bottom chords.
  - 3. Manufacturers:
    - a. CertainTeed Corporation.
    - b. Owens Corning.
    - c. Johns Manville Corporation.
- C. Acoustical Insulation (Sound Attenuation Blankets): See Division 09 Section "Gypsum Board Assemblies."
- D. Polyurethane Foam Insulation (Minimal Expansive): Single- or two-component, UL classified sealant, to insulate, seal, fill, and stop air infiltration; shall not expand to the point to cause pressure on window and door jambs.
  - 1. Density: 1.2 lbs./cu. ft.
  - 2. R-Value: Not less than 4.0 per inch of thickness.
  - 3. Fire-Test-Response Characteristics: ASTM E 84, as follows:
    - a. Flame Spread: 25.
    - b. Smoke Developed: 50.
  - 4. Manufacturers:
    - a. Insta-Foam Products Inc., Joliet, IL 60435, (800) 800-FOAM.
    - b. Fomo Products Inc., Norton, OH 44203, (800) 321-5585.
    - c. Convenience Products, Fenton, MO 63026, (800) 325-6180.

## 2.3 VAPOR RETARDERS

- A. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.

- B. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

#### 2.4 AUXILIARY INSULATING MATERIALS

- A. Insulation Support Rods: Carbon steel wire, 13 gage, with sharp pointed ends; designed for 16 inches o.c. spacing.
  - 1. Product: SoundAway Corp.; IS16 Insulation Support Rods.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Clean substrates of substances harmful to insulations or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

#### 3.3 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.
  - 1. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice and snow.
- C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- D. Apply single layer of insulation to produce thickness indicated, unless multiple layers are otherwise shown or required to make up total thickness.

#### 3.4 INSTALLATION OF GENERAL BUILDING INSULATION

- A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units. Fill voids in thermal envelope not covered by the work of other sections.

- B. Ceiling Insulation: Place insulation in two-layer application consisting of a layer of 6-inch thick batt insulation between bottom chords of trusses or framing covered with a layer of 10-inch thick batt insulation laid perpendicular to bottom chords of trusses or framing.

### 3.5 INSTALLATION OF FOAM-IN-PLACE INSULATION

- A. Install foam-in-place insulation sealant to a minimum depth of 1 inch, sealing construction cracks and gaps where outside air and cold can infiltrate, providing an airtight building envelope.

### 3.6 INSULATION OF STEEL DOOR FRAMES

- A. Exterior Frames: Steel door frames in exterior walls shall be filled with insulation. Cut rigid insulation slab the full width of frame throat and insert continuous slab into door frame head and jambs before frame is installed. After frames are installed, fill remaining gap between rigid insulation and air infiltration barrier with foam-in-place insulation.

### 3.7 INSTALLATION OF VAPOR RETARDERS

- A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.
- B. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's instructions. Seal butt joints and fastener penetrations with vapor-retarder tape. Locate all joints over framing members or other solid substrates.
- C. Firmly attach vapor retarders to substrates with mechanical fasteners as recommended by vapor-retarder manufacturer.
- D. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating objects and vapor retarder.
- E. Repair any tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

### 3.8 PROTECTION

- A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 072100

## SECTION 075910 - SINGLE-PLY MEMBRANE ROOF PATCHING

### 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 the following:
  - 1. Alterations and patching to the existing EPDM roofing system.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for wood nailers, curbs, and blocking.

#### 1.3 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this Section.

#### 1.4 DESIGN REQUIREMENTS

- A. Roof flashing details shall be consistent with those shown on the drawings. Where cap flashing is shown, a standard manufacturer's bar anchor only detail is not acceptable. Membrane manufacturer's recommended flashing detail may be considered by the Architect when no detail is provided.

#### 1.5 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Shop Drawings: Submit shop drawings for roofing system replacement patches and restoration work, including roof modification locations, penetration and flashing details, and special conditions.
  - 1. Submit copy of shop drawings to manufacturer of existing roofing for review and approval to maintain existing warranty, if still in effect.
- C. Warranties: Special warranties specified in this Section.

#### 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain primary single-ply membrane roofing from original manufacturer. Provide secondary materials by same manufacturer or as recommended in writing by manufacturer of primary materials.
- B. Coordinate alterations to existing roofing with original manufacturer to maintain warranty, if still in effect. The results of the warranty inspection by the system manufacturer shall be submitted in writing to Owner for their review and records.



## 1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing and mixing with other components. Comply with manufacturer's written instructions for proper material storage.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
  - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck.
- D. Do not overload any portion of building, either by use of or placement of equipment, storage of debris, or storage of materials. Construction loads shall not exceed 25 pounds per square foot.

## 1.8 PROJECT CONDITIONS

- A. Weather: Proceed with work when existing and forecasted weather conditions permit work to be performed in accordance with manufacturer's written recommendations and warranty requirements.
- B. Substrate Conditions: Do not begin roofing installation until substrates have been inspected and are determined to be in satisfactory condition. All surfaces shall be smooth, dry, clean, free of fins or sharp edges, loose or foreign materials, oil or grease. No work shall proceed when moisture is present on the roof or in the substrate materials.
- C. Protect existing roofing at access locations, work areas and construction traffic locations with plywood or other appropriate material to prevent damage to the existing roof system. Remove upon completion of the work.

## 1.9 WARRANTY

- A. Notify manufacturer of existing roofing and assist Owner in applying for continuation of original warranty, if still in effect.
- B. Special Project Warranty: Upon completion of the work and prior to acceptance of the work, the Roofing Contractor shall submit a guarantee to Owner. The guarantee shall be for a 2-year period and shall cover any defect in the work or materials. Warranty commencement shall be the same date as substantial project completion. This warranty is in addition to the manufacturer's warranty.

## PART 2 - PRODUCTS

### 2.1 GENERAL

- A. Performance: Provide roofing materials identified to be of generic type indicated and tested to show compliance with required performances.
- B. Material Compatibility: Provide roofing materials that are fully compatible with existing materials and one another under conditions of service and application required, as demonstrated by roofing membrane manufacturer based on testing and field experience. Provide separation materials as required to eliminate contact between incompatible materials.

### 2.2 EPDM MEMBRANE

- A. Manufacturer's standard installation to match existing installation type.
- B. EPDM Roofing Membrane: ASTM D 4637, Type I, nonreinforced uniform, flexible sheet made from EPDM.
  - 1. Thickness: Match existing.
  - 2. Exposed Face Color: Match existing.

### 2.3 AUXILIARY MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
- B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, thickness, type, reinforcement, and color as existing EPDM sheet membrane.
- C. Bonding Adhesive: Manufacturer's standard bonding adhesive for EPDM membrane, and solvent-based bonding adhesive for base flashings. Adhesive shall be formulated to withstand minimum 90-psf uplift force.
- D. Metal Flashing Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors. Fasten bar to wall as recommended by membrane manufacturer.
- E. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate, and acceptable to membrane roofing system manufacturer. Fasteners into masonry or concrete shall penetrate minimum of 1-1/2 inches and a minimum 1-inch diameter washer or termination bar to support membrane.
- F. Cleaner: Clear, solvent based cleaner used to loosen and remove dirt and other contaminants from the surface of exposed EPDM membrane to receive restoration repairs.
- G. Miscellaneous Accessories: Provide pourable sealers, preformed cone flashings, preformed inside and outside corner sheet flashings, T-joint covers, termination reglets, cover strips, and other accessories. Provide manufacturer's standard premolded accessories.

## 2.4 INSULATING MATERIALS

- A. General: Provide insulating materials to comply with requirements indicated for materials and with referenced standards in sizes to fit applications indicated, selected from manufacturer's standard thicknesses, widths, and lengths.
  - 1. Provide tapered boards where indicated for sloping to drain. Fabricate with taper of 1/4 inch per foot, unless otherwise indicated.
- B. Match existing insulation and thickness.

## 2.5 AUXILIARY INSULATION MATERIALS

- A. Mechanical Anchors: Corrosion-resistant, fluoropolymer coating; type as recommended by insulation manufacturer for deck type and complying with fire and insurance wind-uplift rating requirements.
  - 1. Provide system tested and approved for I-90 wind-uplift rating.
- B. Cold Fluid-Applied Adhesive: Manufacturer's standard cold fluid-applied adhesive formulated to adhere roof insulation to substrate.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine and document existing substrates, areas, and conditions, with Installer present, for compliance with the roofing system manufacturer's requirements.
  - 1. Document deteriorated roof conditions such as wet insulation that are encountered and need correcting.
  - 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARING SUBSTRATE

- A. General: Comply with manufacturers' instructions to prepare substrate to receive single-ply membrane system.
- B. Clean substrate of dust, debris, and other substances detrimental to single-ply system installation. Remove sharp projections.
- C. Existing Membrane Cleaning: Remove as much loose material s possible from the membrane surface where restoration work occurs. Accumulated dirt that is built up on the surface shall be cleaned with detergent and water. Rinse area thoroughly with clean water and allow to dry completely.
- D. Install flashings, and accessory items as shown and as recommended by manufacturer.
- E. Prime substrate or install slip sheet where recommended by manufacturer of materials being installed.

- F. Prevent materials from entering and clogging drains and conductors and from spilling or migrating onto surfaces of other work.
- G. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at the end of the workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

### 3.3 INSTALLING INSULATION

- A. General: Where required, extend insulation full thickness in two layers, or in multiple layers over entire surface to be insulated to match thickness of existing insulation, cutting and fitting tightly around obstructions. Form crickets, saddles, and tapered areas with additional material as required for proper drainage of membrane.
  - 1. Provide tapered units to suit existing drainage pattern.
- B. Secure roof insulation to substrate with mechanical anchors of type and spacing required by the system manufacturer, but in no case provide less than one anchor per 4 sq. ft. of surface area or less anchorage than required by FM Loss Prevention Data Sheet 1-28.

### 3.4 INSTALLING MEMBRANE

- A. Install roofing membrane over area to receive roofing according to roofing system manufacturer's written instructions.
- B. Accurately align roofing membranes and maintain uniform side and end laps of minimum dimensions required by manufacturer.
- C. Fasteners shall be of sufficient length to penetrate all layers of insulation and minimum of 3/4 inch beyond structural deck.
- D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.
- E. Apply roofing membrane with side laps shingled with slope of roof deck where possible.
- F. Seams: Clean seam areas with manufacturers recommended cleaning solution, overlap roofing membrane and hot-air weld seam tape side and end laps of roofing membrane according to manufacturer's written instructions to ensure a watertight seam installation.
  - 1. Repair tears, voids, and lapped seams in roofing membrane that does not meet requirements.
- G. Install roofing membrane and auxiliary materials to tie in to existing roofing.

### 3.5 FLASHING INSTALLATION

- A. Install sheet flashings and preformed flashing accessories and adhere to substrates according to membrane roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate and allow to partially dry. Do not apply bonding adhesive to seam area of flashing.

- C. Flash penetrations and field-formed inside and outside corners with sheet flashing.
- D. Clean seam areas and overlap and firmly roll sheet flashings into the adhesive. Weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

### 3.6 PROTECTING AND CLEANING

- A. Protect membrane roofing system from damage and wear during remainder of construction period. When remaining construction will not affect or endanger roofing, inspect roofing for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove membrane roofing system that does not comply with requirements, repair substrates, and repair or reinstall membrane roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

### 3.7 ROOFING INSTALLER'S WARRANTY (For roof that does not carry a current manufacturer's warranty)

- A. WHEREAS <Insert name> of <Insert address>, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
  - 1. Owner: <Insert name of Owner.>
  - 2. Address: <Insert address.>
  - 3. Building Name/Type: <Insert information.>
  - 4. Address: <Insert address.>
  - 5. Area of Work: <Insert information.>
  - 6. Acceptance Date: <Insert date.>
  - 7. Warranty Period: <Insert time.>
  - 8. Expiration Date: <Insert date.>
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- D. This Warranty is made subject to the following terms and conditions:
  - 1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
    - a Lightning;
    - b Peak gust wind speed exceeding 55 mph;
    - c Fire;
    - d Failure of roofing system substrate, including cracking, settlement, excessive

- e deflection, deterioration, and decomposition;
  - e Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
  - f Vapor condensation on bottom of roofing; and
  - g Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
  3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
  4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
  5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
  6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
  7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.

1. Authorized Signature: **<Insert signature>**.
2. Name: **<Insert name>**.
3. Title: **<Insert title>**.

END OF SECTION 075910

## SECTION 078413 - THROUGH-PENETRATION FIRESTOP 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. Penetrations in fire-resistance-rated walls.
  - 2. Penetrations in horizontal assemblies.
  - 3. Penetrations in smoke barriers.
- B. Related Sections:
  - 1. Division 07 Section "Joint Sealants" for non-fire-resistive joint sealants.
  - 2. Division 09 Section "Gypsum Board Assemblies" for firestopping where fire rated gypsum board assemblies butt adjacent construction including masonry, steel deck, joists, beams, floors, roofs and structural members.
  - 3. Division 26 Sections specifying cable and conduit penetrations.

#### 1.3 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For each through-penetration firestop system, show each kind of construction condition penetrated, relationships to adjoining construction, and kind of penetrating item. Include firestop design designation of testing and inspecting agency acceptable to authorities having jurisdiction that evidences compliance with requirements for each condition required.
  - 1. Submit documentation, including illustrations applicable to each through-penetration firestop system configuration for construction and penetrating items.
- D. 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.
- E. Qualification Data: For qualified Installer.
- F. Installer Certificates: From Installer indicating penetration firestopping has been installed in compliance with requirements and manufacturer's written recommendations.

- G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified, independent testing agency, for penetration firestopping.

#### 1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A firm experienced in installing penetration firestopping similar in material, design, and extent to that required for this Project, whose work has resulted in construction with a record of successful performance. Qualifications include having the necessary experience, staff, and training to install manufacturer's products per specified requirements. Manufacturer's willingness to sell its penetration firestopping products to Contractor or to Installer engaged by Contractor does not in itself confer qualification on buyer.
- B. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.
- C. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
  - 1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.
  - 2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    - a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    - b. Classification markings on penetration firestopping correspond to designations listed by the following:
      - 1) UL in its "Fire Resistance Directory."
      - 2) Intertek ETL SEMKO in its "Directory of Listed Building Products."
      - 3) FM Global in its "Building Materials Approval Guide."
- D. Provide through-penetration firestop system products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- E. 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 penetration firestopping when ambient or substrate temperatures are outside limits permitted by penetration firestopping manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced-air circulation.

## 1.7 COORDINATION

- A. Coordinate Work of this Section with the work of other trades to assure the proper sequencing of each installation and to provide a fire- and smoke-resistant installation.
- B. Coordinate construction of openings and penetrating items to ensure that penetration firestopping is installed according to specified requirements.
- C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping.
- D. Notify Owner's testing agency at least seven days in advance of penetration firestopping installations; confirm dates and times on day preceding each series of installations.
- E. 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. A/D Fire Protection Systems Inc.
  - 2. Grace Construction Products.
  - 3. Hilti, Inc.
  - 4. Johns Manville.
  - 5. Nelson Firestop Products.
  - 6. NUCO Inc.
  - 7. Passive Fire Protection Partners.
  - 8. RectorSeal Corporation.
  - 9. Specified Technologies Inc.
  - 10. 3M Fire Protection Products.
  - 11. Tremco, Inc.; Tremco Fire Protection Systems Group.
  - 12. USG Corporation.

### 2.2 PENETRATION FIRESTOPPING

- A. Provide penetration firestopping that is produced and installed to resist spread of fire according to requirements required, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be

compatible with one another, with the substrates forming openings, and with penetrating items if any.

1. Provide paintable through-penetration firestop products at locations exposed to view in public spaces. Mechanical, electrical and elevator machine rooms are not considered public spaces.
- B. Penetrations in Fire-Resistance-Rated Walls: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of **0.01-inch wg**.
1. Fire-resistance-rated walls include fire-barrier walls, smoke-barrier walls and fire partitions.
  2. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Provide penetration firestopping with ratings determined per ASTM E 814 or UL 1479, based on testing at a positive pressure differential of **0.01-inch wg**.
1. Horizontal assemblies include floors and floor/ceiling assemblies.
  2. F-Rating: At least 1 hour, but not less than the fire-resistance rating of constructions penetrated.
- D. Penetrations in Smoke Barriers: Provide penetration firestopping with ratings determined per UL 1479.
1. L-Rating: Not exceeding **5.0 cfm/sq. ft.** of penetration opening at **0.30-inch wg** at both ambient and elevated temperatures.
- E. Exposed Penetration Firestopping: Provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.
- F. VOC Content: Provide penetration firestopping that complies with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
1. Architectural Sealants: 250 g/L.
  2. Sealant Primers for Nonporous Substrates: 250 g/L.
  3. Sealant Primers for Porous Substrates: 775 g/L.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping manufacturer and approved by qualified testing and inspecting agency for firestopping indicated.
1. Permanent forming/damming/backing materials, including the following:
    - a. Slag-wool-fiber or rock-wool-fiber insulation.
    - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
    - c. Fire-rated form board.
    - d. Fillers for sealants.
  2. Temporary forming materials.
  3. Substrate primers.
  4. Collars.
  5. Steel sleeves.

## 2.3 FILL MATERIALS

- A. 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.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized-steel sheet.
- E. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. 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 nonshrinking, homogeneous mortar.
- H. 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. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. 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 nonsag formulation for openings in vertical and sloped surfaces, unless indicated firestopping limits use of nonsag grade for both opening conditions.

## 2.4 MIXING

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

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 PREPARATION

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

### 3.3 INSTALLATION

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

### 3.4 IDENTIFICATION

- A. Identify penetration firestopping with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within **6 inches** of firestopping edge so labels will be visible to anyone seeking to remove penetrating items or firestopping. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
  - 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
  - 2. Contractor's name, address, and phone number.
  - 3. Designation of applicable testing and inspecting agency.
  - 4. Date of installation.
  - 5. Manufacturer's name.
  - 6. Installer's name.

### 3.5 FIELD QUALITY CONTROL

- A. Owner may engage a qualified testing agency to perform tests and inspections.
- B. Allow for 3 random samples of each type of firestopping system to be inspected. Reinstall disturbed samples to comply with requirements.
- C. Where deficiencies are found or penetration firestopping is damaged or removed because of testing, repair or replace penetration firestopping to comply with requirements.
  - 1. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- D. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

### 3.6 CLEANING AND PROTECTION

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

END OF SECTION 078413

## SECTION 079200 - JOINT SEALANTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes joint sealants for the following applications, including those specified by reference to this Section:
  - 1. Exterior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Joints in exterior insulation and finish systems.
    - b. Perimeter joints between materials listed above and frames of doors and windows .
    - c. Other joints as indicated.
  - 2. Exterior joints in the following horizontal traffic surfaces:
    - a. Isolation and contraction joints in cast-in-place concrete slabs.
    - b. Other joints as indicated.
  - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Perimeter joints of exterior openings where indicated.
    - b. Vertical joints on exposed surfaces of walls and partitions.
    - c. Perimeter joints between interior wall surfaces and frames of interior doors and windows.
    - d. Other joints as indicated.
- B. Related Sections include the following:
  - 1. Division 07 Section "Through-Penetration Firestop Systems" for sealing penetrations in fire-resistance-rated construction.
  - 2. Division 08 Section "Glazing" for glazing sealants.
  - 3. Division 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of gypsum board partitions to reduce sound transmission.
  - 4. Divisions 21, 22, 23, and 26 for sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, telecommunication systems, and electrical systems.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that have been produced and installed to establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.
- B. Provide joint sealants for interior applications that establish and maintain airtight and water-resistant continuous joint seals without staining or deteriorating joint substrates.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each joint-sealant product indicated.

- C. Samples for Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. LEED Submittals:
  - 1. Credit EQ 4.1: Manufacturers' product data for interior sealants, including printed statement of VOC content.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed joint sealant applications similar in materials, design, and extent to that indicated for Project that have resulted in construction with a record of successful in-service performance.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration period for use, shelf/pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.
- C. Remove and replace materials, at no cost to Owner, that cannot be applied within their stated shelf life.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Conditions: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
  - 2. When joint substrates are wet.
  - 3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
  - 4. Contaminants capable of interfering with adhesion have not yet been removed from joint substrates.
- B. Joint Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than allowed by joint sealant manufacturer for application indicated.
- C. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

#### 1.8 SEQUENCING AND SCHEDULING

- A. Coordinate Work of this Section with interfacing and adjoining Work for proper sequencing of each installation to ensure a weathertight installation.

## 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 sealant manufacturer, based on testing and field experience.
- B. VOC Content of Interior Sealants: Provide interior sealants and sealant primers that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
  - 1. Sealants: 250 g/L.
  - 2. Sealant Primers for Nonporous Substrates: 250 g/L.
  - 3. Sealant Primers for Porous Substrates: 775 g/L.
- C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

### 2.2 JOINT SEALANTS

- A. Type 1 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type S, Grade NS, Class 25; single component.
  - 1. Sonolastic NP-1; Sonneborn, Division of ChemRex Inc.
  - 2. Dymonic; Tremco, Inc.
  - 3. Sikaflex-1a; Sika Corporation, Inc.
  - 4. Dynatrol 1; Pecora Corporation.
  - 5. Vulkem 116; Tremco, Inc.
  - 6. Chem-Calk 900; Bostik Findley.
- B. Type 2 - General Purpose Exterior Sealant: Polyurethane; ASTM C920, Type M, Grade NS, Class 25; two-component.
  - 1. Sonolastic NP-2; Sonneborn, Division of ChemRex Inc.
  - 2. Dymeric 240/240FC; Tremco, Inc.
  - 3. Sikaflex-2c, NS; Sika Corporation, Inc.
  - 4. Dynatrol 2; Pecora Corporation.
  - 5. Vulkem 922; Tremco, Inc.
  - 6. Chem-Calk 500; Bostik Findley.
- C. Type 3 - General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
  - 1. Tremflex 834; Tremco, Inc.
  - 2. AC-20; Pecora Corporation.
  - 3. Chem-Calk 600; Bostik Findley.
- D. Type 4 - Plumbing Fixture/Tile Sealant: Silicone; ASTM C920, Uses M and A; single component, mildew resistant, color selected by Architect.
  - 1. 898 Silicone; Pecora Corporation.
  - 2. Tremsil 200; Tremco, Inc.
- E. Acoustical Sealant: Specified in Section 092950.

### 2.3 JOINT-SEALANT BACKING



- A. General: Provide sealant backings (backer rods) of material and type 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. Plastic Foam Joint Fillers (Backer Rods): Preformed, compressible, resilient, nonstaining, nonwaxing, nonextruding strips of flexible plastic foam of material indicated below and of size, shape, and density to control sealant depth and otherwise contribute to producing optimum sealant performance:
  - 1. Closed-cell polyethylene foam, nonabsorbent to liquid water and gas, nonoutgassing in unruptured state.
- 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 where such adhesion would result in sealant failure. 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 concrete, masonry unglazed surfaces of ceramic tile, and similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a

combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.

3. Remove laitance and form-release agents from concrete.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. **Joint Priming:** Prime joint substrates, where indicated or recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. 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 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. **Installation of Sealant Backings (Backer Rods):** Install sealant backings to comply with the following requirements:

1. Install sealant backings of type indicated to provide support of 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.
  - a. Do not leave gaps between ends of joint fillers.
  - b. Do not stretch, twist, puncture, or tear joint fillers.
2. Install bond-breaker tape behind sealants where sealant backings (backer rods) are not used between sealants and backs of joints.

D. **Installation of Sealants:** Install sealants using proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

E. **Tooling of Nonsag Sealants:** Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint configuration per Figure 5A in ASTM C 1193, unless otherwise indicated.

### 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.

### 3.6 JOINT-SEALANT SCHEDULE

- A. Joints between Exterior Metal Frames and Adjacent Work (except masonry): Type 2; colors as selected.
- B. Under Exterior Door Thresholds: Type 1.
- C. Exterior Joints for Which No Other Sealant Type is Indicated: Type 2; colors as selected.
- D. Concealed Interior Perimeter Joints of Exterior Openings: Type 1.
- E. Exposed Interior Perimeter Joints of Exterior Openings: Type 3; colors as selected.
- F. Joints between Plumbing Fixtures and Walls and Floors and Between Countertops and Walls: Type 4; colors as selected.
- G. Interior Joints for Which No Other Sealant is Indicated: Type 3; colors as selected.

END OF SECTION 079200

## SECTION 081113 - STEEL FRAMES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Steel frames.
- B. Related Sections include the following:
  - 1. Division 08 Section "Door Hardware" for door hardware.
  - 2. Division 09 Section "Painting" for field painting steel frames.

#### 1.3 DEFINITIONS

- A. Minimum Steel Sheet Thickness: Minimum thickness of base metal without coatings.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
  - 1. Submittals for Division 08 Sections "Steel Frames," "Wood Doors" and "Door Hardware" shall be made concurrently.
- B. Product Data: Include door designation, type, level and model, construction details, material descriptions, core descriptions, label compliance, fire-resistance rating, and finishes for each type of steel frame specified.
- C. Shop Drawings: In addition to requirements below, provide a schedule of steel frames using same reference numbers for details and openings as those on Drawings:
  - 1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 2. Details and locations of reinforcement and preparations for hardware.
  - 3. Details of each different wall opening condition.
  - 4. Details of anchorages, accessories, joints, field splices, and connections.
  - 5. Details of glazing frames and stops showing glazing.
  - 6. Details of conduit and preparations for electrified door hardware and controls.
- D. Door Schedule: Use same reference designations indicated on Drawings in preparing schedule for steel frames. Coordinate with door hardware schedule.
- E. Coordination Drawings: Drawings of each opening, drawn to scale and coordinating door hardware. Show elevations of each frame design type, showing dimensions, locations of door hardware, and preparations for power, signal, and electrified control systems.
- F. Product Test Reports: Based on evaluation of comprehensive fire tests performed by a qualified testing agency, for each type of steel door and frame.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain steel frames through one source from a single manufacturer.
- B. Fire-Rated Sidelight and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- C. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9. Label each individual glazed lite.

## 1.6 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. Inspect frames on delivery for damage; notify shipper and supplier if damage is found. Minor damages may be repaired provided refinished items match new work and are acceptable to Architect. Remove and replace damaged items that cannot be repaired as directed.
- D. Store frames 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. Avoid using nonvented plastic or canvas shelters that could create a humidity chamber.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Ceco Door Products; an Assa Abloy Group Company.
  - 2. CURRIES Company; an Assa Abloy Group Company.
  - 3. Steelcraft; an Ingersoll-Rand Company.

### 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum **A40** metallic coating.

- D. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
- E. 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 steel door frames of type indicated.
- F. Glazing: Comply with requirements in Division 08 Section "Glazing."

## 2.3 STEEL FRAMES

- A. General: Comply with ANSI A250.8 and with details indicated for type and profile. Conceal fastenings, unless otherwise indicated.
- B. Interior Frames: Fabricated from cold-rolled steel sheet, unless otherwise indicated to comply with exterior frame requirements.
  - 1. Fabricate frames with mitered or coped and welded face corners and seamless face joints, unless otherwise indicated.
  - 2. Frames for Wood Doors: 0.053-inch-thick, 16 gage steel sheet, unless otherwise indicated.
  - 3. Frames for Borrowed Lights: 0.042-inch-thick, 18 gage steel sheet, unless otherwise indicated.
  - 4. All welded joints shall be ground and dressed to be smooth, flush, and invisible.
- C. Hardware Reinforcement: Fabricate reinforcement plates of sufficient strength from same material as frames to support hardware without through bolting and to comply with the following minimum sizes:
  - 1. Hinges: Minimum 0.123 inch thick, 10 gage, by 1-1/2 inches wide by 6 inches longer than hinge, secured by not less than 6 spot welds.
  - 2. Lock Face, Flush Bolts, Closers, and Concealed Holders: Minimum 0.067 inch thick, 14 gage.
  - 3. All Other Surface-Mounted Hardware: Minimum 0.067 inch thick, 14 gage.
  - 4. Fabricate concealed stiffeners and hardware reinforcement plates from same material as frames.
  - 5. Locate hardware reinforcement plates as indicated on Shop Drawings or, if not indicated, according to ANSI A250.6.

## 2.4 FRAME ANCHORS

- A. Jamb Anchors:
  - 1. Metal Stud-Wall Type: Slip in wood stud anchor; not less than 0.053 inch thick, 16 gage.
  - 2. Postinstalled Expansion Type for Existing In-Place Masonry Only: 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 thick, 18 gage, and as follows:
  - 1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.5 STOPS AND MOLDINGS

- A. Fixed Frame Moldings: Formed integral with steel frames, minimum **5/8 inch** high, unless otherwise indicated.

## 2.6 FABRICATION

- A. General: Fabricate steel frames 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. Steel 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. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
  - 2. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints; fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding; grind smooth and invisible.
  - 3. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners, unless otherwise indicated.
  - 4. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor. Provide floor anchors for all frames. Floor anchors are in addition to jamb anchors.
  - 5. Jamb Anchors: 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:
    - a. Stud-Wall Type:
      - 1) Three anchors per jamb up to **60 inches** in height.
      - 2) Four anchors per jamb from **60 to 90 inches** in height.
      - 3) Five anchors per jamb from **90 to 96 inches** in height.
      - 4) Five anchors per jamb plus 1 additional anchor per jamb for each **24 inches** or fraction thereof more than **96 inches** in height.
      - 5) Two anchors per head for frames more than **42 inches** wide and mounted in metal-stud partitions.
    - b. Postinstalled Expansion Type at Existing Masonry Only: Locate anchors not more than **6 inches** from top and bottom of frame. Space anchors not more than **26 inches** o.c.
  - 6. Door Silencers: Except on weather-stripped doors, drill stops to receive door silencers as follows. Provide plastic plugs to 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.
  - 7. Provide welded frames with temporary spreader bars for shipping. Shipping spreader bars to be removed before installation, with template jig used to properly square up and space jambs.
- D. Fabricate concealed stiffeners, edge channels, and hardware reinforcement from same material as item is attached to.

- E. Hardware Preparation: Factory prepare steel frames to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping, according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
  - 1. Reinforce frames to receive nontemplated mortised and surface-mounted door hardware. Through bolting will not be acceptable.
  - 2. Comply with applicable requirements in ANSI A250.6 and ANSI/DHI A115 Series specifications for door and frame preparation for hardware. Locate hardware as indicated on Shop Drawings or, if not indicated, according to ANSI/SDI A250.8.
  - 3. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.
  
- F. 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 door or frame.
  - 2. Multiple Glazed Lites: Provide fixed and removable stops and moldings such that each glazed lite is capable of being removed independently.
  - 3. Provide fixed frame moldings on secure side of interior frames.
  - 4. Provide loose stops and moldings on inside of frames.
  - 5. Coordinate rabbet width between fixed and removable stops with type of glazing and type of installation indicated.

## 2.7 STEEL FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Apply primers to steel frames after assembly.
  
- B. Comply with SSPC-PA1, "Paint Application Specification No. 1," for steel sheet finishes.
  
- C. Steel Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning"; remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel; comply with SSPC-SP 3, "Power Tool Cleaning," or SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  
- D. Factory Priming for Field-Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than **0.7 mils**.
  - 1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; compatible with substrate and field-applied finish paint system indicated; and providing a sound foundation for field-applied topcoats despite prolonged exposure.

## 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.



1. If unacceptable conditions are encountered, prepare written report, endorsed by Installer, listing conditions detrimental to performance of Work.

B. 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 steel door frames for squareness, alignment, twist, and plumb 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 frames to receive nontemplated mortised and surface-mounted door hardware.

### 3.3 INSTALLATION

A. General: Provide frames of sizes, thicknesses, and designs indicated. Install steel frames plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Steel Frames: Install steel frames for doors, sidelights, and borrowed lights, 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 due to 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. Remove shipping straps at bottom of frames. Properly space frame using wood template that is full depth of frame and of proper spacing width during setting and anchoring of frames to maintain proper width, with frame plumb and square without twists. Remove temporary braces necessary for installation only after frames have been properly set and secured.
  - e. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor and secure with postinstalled expansion anchors. Floor anchors are in addition to wall 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: Attach wall anchors to studs with screws.
4. Existing In-Place Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
5. Installation Tolerances: Adjust steel 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. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with steel frame 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: Remove and replace defective work, including steel frames that are warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

END OF SECTION 081113

## SECTION 081416 - WOOD DOORS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Solid-core doors with medium-density-overlay or hardboard faces.
  - 2. Shop priming wood doors.
  - 3. Factory fitting wood doors to frames and factory machining for hardware.
  - 4. Factory glazing of wood doors with glazed openings.
- B. Related Sections:
  - 1. Division 08 Section "Aluminum-Framed Entrances and Storefront" for aluminum frames receiving wood doors.
  - 2. Division 09 Sections "Painting" for field finishing of doors with opaque finish.

#### 1.3 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
  - 1. Submittals for Division 08 Sections "Steel Frames," "Wood Doors" and "Door Hardware" shall be made concurrently.
- B. Product Data: For each type of door indicated. Include details of core and edge construction and trim for openings.
  - 1. Submit door manufacturer's storage, handling, finish, installation and maintenance instructions.
- C. 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.
- D. Door Schedule: Submit schedule of doors using same reference numbers for details and openings as those on Contract Drawings.
- E. Warranty: Sample of special warranty.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain all wood doors from single manufacturer.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, "Architectural Wood Flush Doors."

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect wood doors during transit, storage, and handling to prevent damage, soiling and deterioration. Comply with requirements of referenced standard, manufacturer's instructions, and recommendations of WDMA I.S.1, Appendix, "How to Store, Handle, Finish, Install and Maintain Wood Doors."
  - 1. Package doors at factory prior to shipping.
  - 2. Protect doors from extremes of heat and cold. Relative humidity shall not be less than 30 percent nor more than 60 percent.
- B. Mark each door on top and bottom rail with opening number used on Shop Drawings.

## 1.6 PROJECT CONDITIONS

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

## 1.7 WARRANTY

- A. General: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by Contractor under requirements of the Contract Documents.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
    - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
  - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
  - 3. Warranty shall be in effect during the following period of time from date of Substantial Completion:
    - a. Warranty Period for Solid-Core Interior Doors: 5 years.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Algoma Hardwoods, Inc.
  - 2. Eggers Industries.
  - 3. Marshfield Door Systems, Inc.

## 2.2 DOOR CONSTRUCTION, GENERAL

### A. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

## 2.3 DOORS FOR OPAQUE FINISH

### A. Interior Solid-Core Doors:

1. Grade: Custom.
2. Faces: Medium-density overlay or hardboard.
3. Exposed Vertical and Top Edges: Any closed-grain hardwood.
4. Core: Particleboard.
5. Construction: Three plies, either bonded or nonbonded construction.
6. WDMA I.S.1-A Performance Grade: Heavy Duty .

## 2.4 LIGHT FRAMES

### A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads as follows unless otherwise indicated.

1. Wood Species: Any closed-grain hardwood.
2. Profile: Manufacturer's standard shape.

## 2.5 GLAZING IN DOORS

### A. Safety Glass for Non-Rated Doors: ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1 (clear); Quality q3 (glazing select); conforming to ANSI Z97.1; 6 mm (0.23 inch) minimum thick.

## 2.6 FABRICATION

### A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.

1. Coordinate sizing of pairs of doors to provide the following maximum gap between leafs to permit proper functioning of dead latching feature:
  - a. Non-Rated Doors: Maximum 3/16-inch gap.

### 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 with hardware mortises in metal frames to verify dimensions and alignment before factory machining.

### C. Openings: Cut and trim openings through doors in factory.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glaze doors at factory with glass of type and thickness indicated. Secure glass in place with removable wood stops.

## 2.7 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime doors with one coat of wood primer specified in Division 09 Section "Painting." Seal all four edges, edges of cutouts, and mortises with primer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

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

### 3.2 INSTALLATION

- A. Hardware: For installation, see Division 08 Section "Door Hardware."
  - 1. Hinges shall be shimmed with metal shims at each door to provide equal clearance at each jamb.
  - 2. Locks, exit devices, door closers and other hardware shall be installed in accordance with the manufacturer's instructions. Pilot holes of recommended size for wood screws required to fasten hardware shall be drilled by installing Contractor before screws are fastened to wood doors.
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge. Coordinate pairs of doors to provide the following maximum gap between leafs and accurate alignment of strike to permit proper functioning of dead latching feature:
  - 1. Non-Rated Doors: Maximum 3/16-inch gap.
- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

### 3.3 ADJUSTING

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

END OF SECTION 081416

## SECTION 084113 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

### 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. Exterior storefront framing.
2. Exterior manual-swing entrance doors and exterior and interior door-frame units.
3. Break metal in conjunction with frames.
4. Door hardware.
5. Sealant at interior and exterior perimeter of storefront.

B. Related Sections:

1. Division 07 Section "Joint Sealants" for installation of joint sealants installed with aluminum-framed systems and for sealants to the extent not specified in this Section.
2. Division 08 Section "Wood Doors" for wood doors in interior aluminum door frames.
3. Division 08 Section "Glazing" for glazing requirements to the extent not specified in this Section.
4. Division 26 Sections for electrical connections including conduit and wiring for door controls and operators.

- C. ADA/ABA Accessibility Guidelines: U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disability Act (ADA) and Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities."

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General Performance: Aluminum-framed systems shall withstand the effects of the following performance requirements without exceeding performance criteria or failure due to defective manufacture, fabrication, installation, or other defects in construction:

1. Movements of supporting structure indicated on Drawings including, but not limited to, story drift and deflection from uniformly distributed and concentrated live loads.
2. Dimensional tolerances of building frame and other adjacent construction.
3. Failure includes the following:
  - a. Deflection exceeding specified limits.
  - b. Thermal stresses transferring to building structure.
  - c. Framing members transferring stresses, including those caused by thermal and structural movements to glazing.
  - d. Noise or vibration created by wind and by thermal and structural movements.
  - e. Loosening or weakening of fasteners, attachments, and other components.
  - f. Sealant failure.
  - g. Failure of operating units to function properly.

- B. Structural Loads:

1. Wind Loads: As indicated on Drawings.
  2. Code: IBC 2003.
- C. Deflection of Framing Members:
1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans up to **13 feet 6 inches** and to 1/240 of clear span plus **1/4 inch** for spans greater than **13 feet 6 inches** or an amount that restricts edge deflection of individual glazing lites to **3/4 inch**, whichever is less.
  2. Deflection Parallel to Glazing Plane: Limited to L/360 of clear span or **1/8 inch**, whichever is smaller.
- D. Structural-Test Performance: Provide aluminum-framed systems tested according to ASTM E 330 as follows:
1. When tested at positive and negative wind-load design pressures, systems do not evidence deflection exceeding specified limits.
  2. When tested at 150 percent of positive and negative wind-load design pressures, systems, including anchorage, do not evidence material failures, structural distress, and permanent deformation of main framing members exceeding 0.2 percent of span.
  3. Test Durations: As required by design wind velocity, but not fewer than 10 seconds.
- E. Air Infiltration: Provide aluminum-framed systems with maximum air leakage through fixed glazing and framing areas of **0.06 cfm/sq. ft.** of fixed wall area when tested according to ASTM E 283 at a minimum static-air-pressure difference of **1.57 lbf/sq. ft.**
- F. Water Penetration under Static Pressure: Provide aluminum-framed systems that do not evidence water penetration through fixed glazing and framing areas when tested according to ASTM E 331 at a minimum static-air-pressure difference of 20 percent of positive wind-load design pressure, but not less than **6.24 lbf/sq. ft.**
- G. Thermal Movements: Provide aluminum-framed systems that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures. 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.
- H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 62 when tested according to AAMA 1503.
- I. Thermal Conductance: Provide aluminum-framed systems with fixed glazing and framing areas having an average U-factor of not more than **0.44 Btu/sq. ft. x h x deg F** when tested according to AAMA 1503.
- 1.4 SUBMITTALS
- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for aluminum-framed systems.



- C. Shop Drawings: For aluminum-framed systems. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Include details of provisions for system expansion and contraction and for drainage of moisture in the system to the exterior.
  - 2. For entrance doors, include hardware schedule and indicate operating hardware types, functions, quantities, and locations.
  - 3. Indicate fastener layout and size for transferring loads back to supporting structure.
- D. Samples for Initial Selection of Sealant Color: For units with factory-applied color finishes. Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for aluminum-framed systems, indicating compliance with performance requirements.
- F. Maintenance Data: For aluminum-framed systems to include in maintenance manuals.
  - 1. Include maintenance manuals for hardware provided in this Section.
  - 2. Include replacement parts lists, adjustment instructions, and maintenance requirements for all components and hardware.
- G. Warranties: Sample of special warranties.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Testing Agency Qualifications: Qualified according to ASTM E 699 for testing indicated.
- C. Engineering Responsibility: Prepare data for aluminum-framed systems, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in systems similar to those indicated for this Project.
- D. Accessible Entrances: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code - Aluminum."

#### 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of structural supports for aluminum-framed systems by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Coordinate rough opening, masonry opening, and wood blocking requirements.

#### 1.7 MAINTENANCE SERVICE

- A. Entrance Door Hardware:

1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
  1. Kawneer Company, Inc.:
    - a. Exterior Storefront and Entrances: 451T frames with 350 Medium Stile Entrances and Frames.
  2. Vistawall Architectural Products:
    - a. Exterior Storefront and Entrances: Series 3000 poured and debridged Thermal Storefront System with 350 Medium Stile Entrances and Frames.

### 2.2 MATERIALS

- A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
  1. Sheet and Plate: **ASTM B 209**.
  2. Extruded Bars, Rods, Profiles, and Tubes: **ASTM B 221**.
  3. Extruded Structural Pipe and Tubes: ASTM B 429.
  4. Structural Profiles: ASTM B 308/B 308M.
  5. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
- B. Steel Reinforcement: Manufacturer's standard zinc-rich, corrosion-resistant primer, complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods according to recommendations in SSPC-SP COM and prepare surfaces according to applicable SSPC standard.
  1. Structural Shapes, Plates, and Bars: ASTM A 36/A 36M.
  2. Cold-Rolled Sheet and Strip: ASTM A 1008/A 1008M.
  3. Hot-Rolled Sheet and Strip: ASTM A 1011/A 1011M.

### 2.3 FRAMING SYSTEMS

- A. Framing Members: Manufacturer's standard extruded-aluminum framing members of thickness required and reinforced as required to support imposed loads.
  1. Construction: As follows:
    - a. Exterior Framing Members: Composite assemblies of two separate extruded-aluminum components permanently bonded by an elastomeric material of low thermal conductance.
  2. Glazing System: Retained mechanically with gaskets on four sides.
  3. Glazing Plane: Center.
  4. Provide components having face width indicated on Drawings.
  5. Provide thermally broken extruded aluminum subframes for storefront sills.
  6. Provide thermally broken extruded aluminum sill flashing with end dams for storefronts.
  7. Provide operable units (doors) manufactured by storefront system manufacturer.

- B. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- C. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
  - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
  - 2. Reinforce members as required to receive fastener threads.
  - 3. Do not use exposed fasteners, except for hardware application. For hardware application, use exposed fasteners with countersunk Phillips screw heads, finished to match framing system or hardware being fastened, unless otherwise noted. Exposed fasteners shall be stainless steel.
- D. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts, complying with ASTM A 123/A 123M or ASTM A 153/A 153M.
- E. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.
- F. Aluminum Break Metal: Form exposed flashing from sheet aluminum finished to match framing and of sufficient thickness, not less than 0.063-inch thick, to maintain a flat appearance without visible deflection.
- G. Framing System Gaskets and Sealants: Manufacturer's standard, recommended by manufacturer for joint type.

## 2.4 GLAZING SYSTEMS

- A. Glazing: As specified in Division 08 Section "Glazing."
- B. Glazing Gaskets: Manufacturer's standard pressure-glazing system of black, extruded EPDM rubber gaskets, fabricated to comply with system performance requirements. Provide gasket assemblies that have corners sealed with sealant recommended by gasket manufacturer.
- C. Spacers and Setting Blocks: Manufacturer's standard permanent, nonmigrating types in hardness recommended by manufacturer, compatible with sealants, and suitable for system performance requirements.
- D. Framing system gaskets, sealants, and joint fillers as recommended by manufacturer for joint type.
- E. Sealants and Joint Fillers (Backer Rods): Provide for joints at perimeter of entrance and storefront systems as specified in Division 07 Section "Joint Sealants."

## 2.5 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: Manufacturer's standard glazed entrance doors for manual- and power-assisted- swing operation.
  - 1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with

reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

2. Door Design: Medium stile; **3-1/2-inch** nominal width, 10-inch high bottom rail, and 6-inch cross rail.
3. Glazing Stops and Gaskets: Square, snap-on, extruded-aluminum stops and preformed gaskets; finished to match frame.
  - a. Provide nonremovable glazing stops on outside of exterior door.

## 2.6 ENTRANCE DOOR HARDWARE

- A. General: Provide heavy-duty units in sizes, numbers, and types recommended by entrance system and hardware manufacturers for entrances and uses indicated. Finish exposed parts to match door finish, unless otherwise indicated. Provide specified manufacturers without substitution.
  1. Opening-Force Requirements:
    - a. Egress Doors: Not more than **15 lbf** to release the latch and not more than **30 lbf** to set the door in motion[ and not more than **15 lbf** to open the door to its minimum required width].
- B. Ball-Bearing Hinges:
  1. Material: Stainless steel, including pin.
  2. Provide nonremovable pins (NRP) at hinges exposed to outside of exterior doors and to nonsecured side of interior doors.
  3. Quantities:
    - a. For doors with heights up to **87** inches, provide 3 hinges per leaf.
    - b. For doors with heights of greater than **87 and up to 120 inches**, provide 4 hinges per leaf.
- C. Weather Stripping: Manufacturer's standard replaceable components.
  1. Compression Type: Made of ASTM D 2000, molded neoprene, or ASTM D 2287, molded PVC. Provide at head and jamb of all exterior doors.
- D. Weather Sweeps: Manufacturer's standard exterior-door bottom sweep with concealed fasteners on mounting strip.
- E. Thresholds: BHMA A156.21, raised thresholds beveled with a slope of not more than 1:2, with maximum height of **1/2 inch**. Coordinate cutouts for operating hardware with anchors and jamb clips.
  1. Material: Aluminum, mill finish.
- F. Balance of Hardware: See Division 08 Section "Door Hardware."

## 2.7 ACCESSORY MATERIALS

- A. Joint Sealants: For installation at perimeter of aluminum-framed systems, as specified in Division 07 Section "Joint Sealants."
- B. Bituminous Paint: Cold-applied, asphalt-mastic paint complying with SSPC-Paint 12 requirements except containing no asbestos; formulated for **30-mil** thickness per coat.

## 2.8 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Framing Members, General: Fabricate components that, when assembled, have the following characteristics:
  - 1. Profiles that are sharp, straight, and free of defects or deformations.
  - 2. Accurately fitted joints with ends coped or mitered.
  - 3. Means to drain water passing joints, condensation within framing members, and moisture migrating within the system to exterior.
  - 4. Physical and thermal isolation of glazing from framing members.
  - 5. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
  - 6. Provisions for field replacement of glazing from interior.
  - 7. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
  - 1. At exterior doors, provide compression weather stripping at fixed stops.
- F. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
  - 1. At exterior doors, provide weather sweeps applied to door bottoms and compression weather stripping at fixed stops.
- G. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed and field-installed entrance door hardware before applying finishes.
- H. After fabrication, clearly mark components to identify their locations in Project according to Shop Drawings.

## 2.9 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. High-Performance Organic Finish: 2-coat fluoropolymer finish complying with AAMA 2605 and containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
  - 1. Color and Gloss: As selected by Architect from manufacturer's full range.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
  - 1. Confirm that wood blocking, where used, has been sufficiently fastened to transfer storefront loads back to structure.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. General:
  - 1. Comply with manufacturer's written instructions.
  - 2. Do not install damaged components.
  - 3. Fit joints to produce hairline joints free of burrs and distortion.
  - 4. Rigidly secure nonmovement joints.
  - 5. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration.
  - 6. Seal joints watertight unless otherwise indicated.
- B. Metal Protection:
  - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or applying sealant or tape, or by installing nonconductive spacers as recommended by manufacturer for this purpose.
  - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- C. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within the system to exterior.
- D. Install components plumb and true in alignment with established lines and grades, and without warp or rack.
- E. Install glazing as specified in Division 08 Section "Glazing."
- F. Entrance Doors: Install doors to produce smooth operation and tight fit at contact points.
  - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
  - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware according to entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.
  - 3. Install hardware furnished in Division 08 Section "Door Hardware."
- G. Install perimeter joint sealants as specified in Division 07 Section "Joint Sealants" to produce weathertight installation. Color of sealant to match aluminum finish.

### 3.3 ERECTION TOLERANCES

- A. Install aluminum-framed systems to comply with the following maximum erection tolerances:

1. Location and Plane: Limit variation from true location and plane to **1/8 inch in 12 feet; 1/4 inch** over total length.
2. Alignment:
  - a. Where surfaces abut in line, limit offset from true alignment to **1/16 inch**.
  - b. Where surfaces meet at corners, limit offset from true alignment to **1/32 inch**.

B. Diagonal Measurements: Limit difference between diagonal measurements to **1/8 inch**.

### 3.4 ADJUSTING AND CLEANING

- A. Adjust operating entrance door hardware to function smoothly as recommended by manufacturer.
  1. For entrance doors accessible to people with disabilities, adjust closers to provide a 3-second closer sweep period for doors to move from a 70-degree open position to **3 inches** from the latch, measured to the leading door edge.
  2. Provide tight fit at contact points and weather stripping. Provide smooth operation and weathertight closure. Frame shall be free from distortion.
- B. Remove excess sealant and glazing compounds and dirt from surfaces. Remove nonpermanent labels and clean surfaces.
- C. Comply with manufacturer's written recommendations for final cleaning and maintenance.

### 3.5 PROTECTION

- A. Provide final protection and maintain conditions in a manner acceptable to manufacturer and Installer that ensures entrances and storefront systems are without damage or deterioration at time of Substantial Completion.

END OF SECTION 084113

## SECTION 085250 - CLAD WOOD WINDOWS

### 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 the following aluminum-clad wood-framed window product types:
  - 1. Double-hung windows.
  - 2. Exterior aluminum-clad wood door and frame with transom windows.
- B. Related Sections include the following:
  - 1. Division 09 Section "Painting" for opaque finish of interior of window unit.
- C. DEFINITIONS
- D. Performance grade number according to AAMA/WDMA 101/I.S.2/NAFS:
  - 1. Design pressure number in pounds force per square foot used to determine the structural test pressure and water test pressure.
- E. Structural Test Pressure: For uniform load structural test, is equivalent to 150 percent of the design pressure.
- F. Minimum Test Size: Smallest size permitted for performance class (gateway test size). Products must be tested at minimum test size or at a size larger than minimum test size to comply with requirements for performance class.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. General: Provide wood windows capable of complying with performance requirements indicated, based on testing manufacturer's windows that are representative of those specified and that are of test size indicated below:
  - 1. Size indicated on Drawings.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: Include construction details, material descriptions, fabrication methods, dimensions of individual components and profiles, hardware, finishes, and operating instructions for each type of wood window indicated.
- C. Shop Drawings: Include plans, building elevations at 1/4-inch = 1 foot scale, unit elevations at 3/4-inch = 1 foot scale, sections and details at full scale, hardware, attachments to other Work, operational clearances, installation details, and the following:
  - 1. Mullion details, including reinforcement and stiffeners.
  - 2. Joinery details.



3. Expansion provisions.
  4. Flashing and drainage details.
  5. Weather-stripping details.
  6. Glazing details.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed within the last four years by a qualified testing agency, for each type, class, grade, and size of wood window. Test results based on use of downsized test units will not be accepted.
- E. Maintenance Data: For operable window sash and doors, operating hardware, weather stripping, and finishes to include in maintenance manuals.
- F. Warranty: Special warranty specified in this Section.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain clad wood windows and doors through one source from a single manufacturer.
- B. Product Options: Drawings indicate size, profiles, dimensional requirements, and aesthetic effects of wood windows and are based on the specific window type and system indicated. Refer to Division 01 Section "Product Requirements." Do not modify size and dimensional requirements.
1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- C. Fenestration Standard: Comply with AAMA/WDMA 101/I.S.2/NAFS, "North American Fenestration Standard Voluntary Performance Specification for Windows, Skylights and Glass Doors," for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.
- D. Glazing Publications: Comply with published recommendations of glass manufacturers and GANA's "Glazing Manual" unless more stringent requirements are indicated.
- E. Insulating Glass Certification Program: Provide insulating glass units permanently marked on spacers or at least on one component pane of units with the appropriate certification label of the inspecting agency indicated below:
1. Insulating Glass Certification Council (IGCC).
  2. Associated Laboratories, Inc. (ALI).
  3. National Certification Testing Laboratories (NCTL).
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to clad wood windows and doors including, but not limited to, the following:
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  2. Review, discuss, and coordinate the interrelationship of clad wood windows and doors with other exterior wall components. Include provisions for structural anchorage, glazing, flashing, tying into weather barrier/air barrier membrane, weeping, sealants, and protection of finishes.

3. Review and discuss the sequence of work required to construct a watertight and weathertight exterior building envelope.
4. Inspect and discuss the condition of substrate and other preparatory work performed by other trades.
5. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
6. Provide 5 business days minimum advance notice to participants prior to convening preinstallation conference.

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify wood window openings by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

## 1.7 WARRANTY

- A. General Warranty: The 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 the Contractor under requirements of the Contract Documents.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace wood windows that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
  1. Failure to meet performance requirements.
  2. Structural failures including excessive deflection.
  3. Water leakage, air infiltration, or condensation.
  4. Faulty operation of movable sash and hardware.
  5. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  6. Insulating glass failure.
- C. Window Warranty Period: Ten years from date of Substantial Completion.
- D. Warranty Period for Metal Finishes: Ten years from date of Substantial Completion.
- E. Warranty Period for Glass: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
  1. Aluminum-Clad Wood Windows and Doors:
    - a. Marvin Windows and Doors:
      - 1) Windows: Clad Ultimate Double Hung.
      - 2) Doors: Clad Ultimate Outswing French Door with Transom.
    - b. Eagle Window and Door, Inc.:
      - 1) Windows: Talon Double-Hungs with jamb liners and Kynar finish.
      - 2) Doors: Ascent Hinged French Doors with Sash-Set Transom; Kynar finish.

- B. Finish Coordination: If Eagle Window and Door, Inc. products are selected for use, coordinate filling and sanding of fastener holes on glazing stops with painting contractor.

## 2.2 MATERIALS, GENERAL

- A. General: Comply with the requirements of AAMA/WDMA 101/I.S.2 and the more stringent requirements listed in this Article.
- B. Wood: Clear ponderosa pine or another suitable fine-grained lumber; kiln-dried to a moisture content of 6 to 12 percent at time of fabrication; free of visible finger joints, blue stain, knots, pitch pockets, and surface checks larger than 1/32 inch deep by 2 inches wide; water-repellent preservative treated.
  - 1. Units designated to have interior natural finish shall be fabricated of solid lumber; no finger joints allowed.
- C. Aluminum Extrusions and Rolled Aluminum for Cladding: Manufacturer's standard formed sheet or extruded-aluminum cladding, mechanically bonded to exterior exposed wood members. Provide aluminum alloy and temper recommended by wood window manufacturer for strength, corrosion resistance, and application of required finish, but not less than 22,000-psi ultimate tensile strength, and not less than 16,000-psi minimum yield strength.
  - 1. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 2. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 3. High-Performance Organic Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
    - a. Fluoropolymer Two-Coat System: Manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight; complying with AAMA 2605.
      - 1) Color and Gloss: As selected by Architect from manufacturer's full range.
- D. Wood Trim and Glazing Stops: Material and finish to match frame members.
  - 1. Provide for interior side of windows and doors.
  - 2. No interior exposed fasteners permitted.
- E. Clad Trim and Glazing Stops for Aluminum Clad Windows and Doors: Hollow extrusions; material and finish to match clad frame members.
  - 1. Provide for exterior side of windows and doors.
- F. Fasteners: Aluminum, nonmagnetic stainless steel, epoxy adhesive, or other materials warranted by manufacturer to be noncorrosive and compatible with wood window members, cladding, trim, hardware, anchors, and other components. Cadmium-plated steel fasteners are not permitted.
  - 1. Exposed Fasteners: Unless unavoidable for applying hardware, do not use exposed fasteners. For application of hardware, use fasteners that match finish of member or hardware being fastened, as appropriate.

- G. Anchors, Clips, and Accessories: Aluminum, nonmagnetic stainless steel, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel anchors, clips, and accessories are not permitted.
- H. Reinforcing Members: Aluminum, nonmagnetic stainless steel, nickel/chrome-plated steel complying with ASTM B 456 for Type SC 3 severe service conditions, or zinc-coated steel or iron complying with ASTM B 633 for SC 3 severe service conditions; provide sufficient strength to withstand design pressure indicated. Cadmium-plated steel reinforcing members are not permitted.
- I. Sliding-Type Weather Stripping: Provide woven-pile weather stripping of wool, polypropylene, or nylon pile and resin-impregnated backing fabric. Comply with AAMA 701/702.
  - 1. Weather Seals: Provide weather stripping with integral barrier fin or fins of semirigid, polypropylene sheet or polypropylene-coated material.

## 2.3 WINDOW

- A. Window Type: Double hung and .
- B. AAMA/WDMA Performance Requirements: Provide wood windows of performance indicated that comply with AAMA/WDMA 101/I.S.2/NAFS, unless more stringent performance requirements are indicated.
  - 1. Performance Grade: DP-45.
- C. Thermal Transmittance: Provide wood windows with a whole-window, U-factor maximum indicated at 15-mph exterior wind velocity and winter condition temperatures when tested according to NFRC 100.
  - 1. U-Factor: 0.35 Btu/sq. ft. x h x deg F or less.
- D. Solar Heat-Gain Coefficient (SHGC): Provide wood windows with a whole-window SHGC maximum of 0.40, determined according to NFRC 200 procedures.
- E. Sound Transmission Class (STC): Provide glazed windows rated for not less than 35 STC when tested for laboratory sound transmission loss according to ASTM E 90 and determined by ASTM E 413.

## 2.4 GLAZING

- A. Glass: Clear, insulating-glass units, argon gas filled, with low-E coating pyrolytic on second surface or sputtered on second or third surface.
- B. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

## 2.5 HARDWARE

- A. General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with wood and aluminum cladding; designed to smoothly operate, tightly close, and securely lock wood windows and sized to accommodate sash or ventilator weight and dimensions. Cadmium-

plated hardware is not permitted. Do not use aluminum in frictional contact with other metals. Where exposed, provide solid white metal hardware with a special coating finish and plated steel or brass/bronze operating bars and rods.

- B. Counterbalancing Mechanism: Comply with AAMA 902.
  - 1. Sash-Balance Type: Concealed spring-loaded, block-and-tackle type of size and capacity to hold sash stationary at any open position.
- C. Locks and Latches for DoubleHung Units: Designed to allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only. Units over 36 inches wide shall have two sash locks.
  - 1. Locks shall have integral tilt release mechanism permitting each sash to be tilted 90 degrees inward from a bottom pivot and positively held in place for washing.
- D. Sash Lifts for DoubleHung Units: Provide sash lifts on all operable double hung windows; units over 36 inches wide shall have two sash lifts.

## 2.6 INSECT SCREENS

- A. General: Design windows and hardware to accommodate screens in a tight-fitting, removable arrangement, with a minimum of exposed fasteners and latches. Locate screens on outside of window. Provide for each operable exterior sash or ventilator.
- B. Aluminum Insect Screen Frames: Manufacturer's standard aluminum alloy complying with SMA 1004. Fabricate frames with mitered or coped joints, concealed fasteners, and removable PVC spline/anchor concealing edge of frame.
  - 1. Finish: Match window members.
- C. Glass-Fiber Mesh Fabric: 18-by-14 or 18-by-16 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration in the following color. Comply with ASTM D 3656.
  - 1. Mesh Color: Charcoal gray.

## 2.7 ALUMINUM-CLAD WOOD DOOR, FRAME AND TRANSOM

- A. Aluminum-Clad Wood Door, Frame and Transom: Aluminum-clad, outswing French door and frame with matching transom unit (sash in frame); interior wood primed for field finishing; and factory glazed. Provide units with manufacturer's standard sill and with nailing flanges.
  - 1. Hardware: Manufacturer's standard multipoint locking system, heavy-duty, stainless steel hinges, weather stripping, and door bottom gasket.
    - a. Lever Handle Style and Finish: Straight lever handle with satin/brushed nickel finish.
  - 2. Glazing: Tempered clear glass. Low-e, tempered insulating glass for exterior doors.
  - 3. Accessories:
    - a. Simulated Divided Lite for Door: Pattern as indicated.
    - b. Mullion Covers: Extruded aluminum matching exterior door finish; wood matching door interior finish.

## 2.8 ACCESSORIES

- A. Simulated Divided Lite for Doors: Provide extruded aluminum bars, finished to match exterior cladding, on outside of sash and primed wood bars for opaque finish on inside of sash.
  - 1. Profile Width: 1-1/8 inch.
- B. Jamb Liner: Provide jamb liner covers, both interior and exterior, for double hung units.
  - 1. Interior Jamb Liners: Shall be wood matching interior finish; no finger joints allowed.
  - 2. Exterior Jamb Liners: Shall be aluminum finished to match aluminum cladding.
- C. Exterior Mullion Covers: One piece, extruded aluminum mullion covers, standard extrusions in size indicated; finish to match frame.
- D. Interior Mullion Covers: Clear ponderosa pine; mullion width x 3/8-inch with chamfered edges.
- E. Reinforcing: Steel or aluminum, as required by window manufacturer for mulled units.

## 2.9 WINDOW FABRICATION

- A. General: Fabricate wood windows, in sizes indicated, that comply with requirements and that meet or exceed AAMA/WDMA 101/I.S.2/NAFS performance requirements for double-hung, windows with minimum DP-45 rating. Include a complete system for assembling components and anchoring windows.
- B. Fabricate wood windows that are reglazable without dismantling sash or ventilator framing.
- C. Weather Stripping: Provide full-perimeter weather stripping for each operable sash and ventilator, unless otherwise indicated.
- D. Factory machine windows for openings and hardware that is not surface applied.
- E. Mullions: Provide mullions and cover plates as shown, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections, as indicated. Provide mullions and cover plates capable of withstanding design loads of window units.
- F. Factory-Glazed Fabrication: Except for light sizes in excess of 100 unitted inches, glaze wood windows in the factory where practical and possible for applications indicated. Comply with requirements in Division 08 Section "Glazing" and with AAMA/WDMA 101/I.S.2/NAFS.
- G. Glazing Stops: Provide glazing stops to match sash and ventilator frames.
- H. Complete fabrication, assembly, mulling of units, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

## 2.10 WOOD FINISHES

- A. Factory-Primed Windows: Provide manufacturer's standard factory-prime coat on exposed interior wood surfaces.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work. Verify rough opening dimensions, levelness of sill plate, and operational clearances. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure a coordinated, weathertight window installation.
  - 1. Wood Frame Walls: Dry, clean, sound, well nailed, free of voids, and without offsets at joints. Ensure that nail heads are driven flush with surfaces in opening and within 3 inches of opening.
  - 2. Verify that rough openings are correct and sill plates are level.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 WINDOW INSTALLATION

- A. General: Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components; Drawings; and Shop Drawings.
- B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction.
  - 1. Maintain alignment with adjacent work.
  - 2. Secure assembly to framed openings without distortion.
  - 3. Center window in opening, rest bottom on sill plate.
  - 4. Leave adequate clearance for caulking around entire perimeter between jambs and masonry.
  - 5. Shim and block as required; check width at center to avoid "hourglass" or bowed out installation.
- C. Set sill members in bed of sealant or with gaskets, as indicated, for weathertight construction.
- D. Metal Protection: Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

### 3.3 DOOR INSTALLATION

- A. Install doors, frames, and transoms plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work.

### 3.4 ADJUSTING

- A. Adjust operating sashes and ventilators, screens, hardware, and accessories for a tight fit at contact points and weather stripping for smooth operation and weathertight closure. Lubricate hardware and moving parts.

### 3.5 PROTECTION AND CLEANING

- A. Protect window surfaces from contact with contaminating substances resulting from construction operations. In addition, monitor window surfaces adjacent to and below exterior concrete and masonry surfaces during construction for presence of dirt, scum, alkaline deposits, stains, or other contaminants. If contaminating substances do contact window surfaces, remove contaminants immediately according to manufacturer's written recommendations.
- B. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.
- C. Clean factory-glazed glass immediately after installing windows. Comply with manufacturer's written recommendations for final cleaning and maintenance. Remove nonpermanent labels and clean surfaces.
- D. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085250



## SECTION 088000 - GLAZING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes glazing for the following products and applications, including those specified in other Sections where glazing requirements are specified by reference to this Section:
  - 1. Windows.
  - 2. Doors.
  - 3. Interior borrowed lites.
  - 4. Storefront framing.
- B. Related Sections include the following:
  - 1. Division 08 Section "Wood Doors" for factory glazing of wood doors with glazed openings.

#### 1.3 DEFINITIONS

- A. Glass Thicknesses: Indicated by thickness designations in millimeters according to ASTM C 1036.
- B. Interspace: Space between lites of an insulating-glass unit that contains dehydrated air or a specified gas.

#### 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. Minimum glass thickness, nominally, is 6.0 mm (0.23 inch), unless indicated otherwise.

#### 1.5 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each glass product and glazing material indicated.

- C. Glazing Schedule: Use same designations indicated on Drawings for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.
- D. Maintenance Data: For glass and other glazing materials to include in maintenance manuals.
- E. Warranties: Special warranties specified in this Section.

## 1.6 QUALITY ASSURANCE

- A. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.
  - 1. Subject to compliance with requirements, obtain safety glazing products permanently marked with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
  - 2. Where glazing units, including Kind FT glass and laminated glass, are specified in Part 2 articles for glazing lites more than 9 sq. ft. in exposed surface area of one side, provide glazing products that comply with Category II materials, and for lites 9 sq. ft. or less in area, provide glazing products that comply with Category I or II materials.
- B. 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."

## 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

## 1.9 WARRANTY

- A. General: Special warranties specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

# 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 2. Products: Subject to compliance with requirements, provide one of the products specified.

## 2.2 MONOLITHIC GLASS PRODUCTS

- A. Uncoated Annealed Float Glass: ASTM C 1036; Type I (transparent flat glass), Class 1 (clear), Quality q3 (glazing select); 6 mm (0.23 inch) thick minimum.
- B. Safety Glass (Tempered Glass): ASTM C 1048; Kind FT (fully tempered), Condition A (uncoated), Type I (transparent flat glass); Class 1 (clear); Quality q3 (glazing select); conforming to ANSI Z97.1; 6 mm (0.23 inch) minimum thick.

## 2.3 INSULATING GLASS PRODUCTS

- A. Insulating-Glass Units, General: Preassembled units consisting of organically sealed lites of glass separated by a dehydrated interspace, complying with ASTM E 774, and with other requirements specified elsewhere.
  - 1. For properties of individual glass lites making up units, refer to requirements specified in "Flat Glass Products" Article of this Section for types, classes, kinds, and conditions of glass products comprising lites of insulating glass units.
  - 2. Provide heat-treated fully tempered, coated float glass of kind indicated or, if not otherwise indicated, Kind HS (heat strengthened) where recommended by manufacturer to comply with system performance requirements specified and Kind FT (fully tempered) where safety glass is designated or required by code.
  - 3. Performance characteristics designated for coated insulating glass are nominal values based on manufacturer's published test data for units with lites **6.0 mm (0.23 inch)** thick and nominal 1/2-inch dehydrated space between lites, unless otherwise indicated.
  - 4. U-values are expressed as Btu/hour x sq. ft. x degrees F.
  - 5. Edge Seal Material: Black color.
  - 6. Spacer Specifications: Manufacturer's standard spacer material and construction.
- B. Clear Low-E Insulated Glass Units: Uncoated insulating glass units complying with ASTM E 773 and E 774; double pane with glass elastomer edge seal.
  - 1. Unit Thickness:
    - a. For Exterior Locations Other Than Doors: Inner and outer panes of **6.0 mm (0.23 inch)** glass; total unit thickness of **1 inch (25 mm)** minimum.
    - b. For Exterior Doors: Inner and outer panes of **3/16 inch** glass; total unit thickness of **5/8 inch** minimum.
  - 2. Interspace Content: Argon.
  - 3. Outdoor Lite: Class 1 (clear) float glass.
    - a. Kind FT (fully tempered) where required by code and where indicated.
  - 4. Indoor Lite: Class 1 (clear) float glass.
    - a. Kind FT (fully tempered) where required by code and where indicated.
  - 5. Low-E Coating: On third surface.

## 2.4 GLAZING GASKETS

- A. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:
  - 1. EPDM, ASTM C 864.
  - 2. Silicone, ASTM C 1115.
  - 3. Thermoplastic polyolefin rubber, ASTM C 1115.
  - 4. Any material indicated above.

## 2.5 GLAZING SEALANTS

- 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.
  3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.
- B. 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.
1. Neutral-Curing Silicone Glazing Sealants: ASTM C 920, Type S, Grade NS, Class 50, Use NT.
    - a. Products:
      - 1) Dow Corning Corporation; 791.
      - 2) Dow Corning Corporation; 795.
      - 3) GE Advanced Materials - Silicones; SilPruf NB SCS9000.
      - 4) GE Advanced Materials - Silicones; UltraPruf II SCS2900.
      - 5) Pecora Corporation; 864.
      - 6) Pecora Corporation; 895.
      - 7) Pecora Corporation; 898.
- C. Structural Glazing Sealants: As recommended by manufacturer for joint type, and as follows:
1. Structural Sealant: ASTM C 1184, chemically curing silicone formulation that is compatible with system components with which it comes in contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in assembly indicated.
    - a. Color: As selected by Architect from manufacturer's full range of colors.

## 2.6 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; packaged on rolls with a release paper backing; and complying with ASTM C 1281 and AAMA 800 for products indicated below:
1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
  2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

## 2.7 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. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

## 2.8 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. Grind smooth and polish exposed glass edges and corners.

## 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.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that will leave visible marks in the completed work.

### 3.3 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Glazing channel dimensions, as indicated on Drawings, provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.
- 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. Protect glass edges as follows:
  - 1. Use a rolling block in rotating glass units to prevent damage to glass corners.
  - 2. Do not impact glass with metal framing.
  - 3. Use suction cups to shift glass units within openings. Do not raise or drift glass with a pry bar.
  - 4. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
- 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 and standards, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- F. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.
- G. Provide spacers for glass lites where length plus width is larger than **50 inches** 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 1/8-inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- H. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and according to requirements in referenced glazing publications.
- I. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- J. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

### 3.4 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first and then to jambs. Cover horizontal framing joints by applying tapes to jambs and then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until just before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.
- G. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

### 3.5 GASKET GLAZING (DRY)

- A. 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.

### 3.6 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

### 3.7 INSTALLATION OF STRUCTURAL SEALANT

- A. Installation of Structural Sealant: Prepare surfaces that will contact structural sealant according to sealant manufacturer's written instructions to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

### 3.8 CLEANING AND PROTECTION

- A. Protect exterior glass from damage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.
- B. Protect glass from contact with contaminating substances resulting from construction operations, 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 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 088000



## SECTION 092950 - GYPSUM BOARD ASSEMBLIES

### 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 the following:
  - 1. Interior gypsum wallboard.
  - 2. Acoustical insulation and sealants.
  - 3. Non-load-bearing steel framing.
- B. Related Sections include the following:
  - 1. Division 09 painting Sections for coordination/inspection requirements with painting contractor and primers applied to gypsum board surfaces.

#### 1.3 DEFINITIONS

- A. Gypsum Board Terminology: Refer to ASTM C 11 and GA-505 for definitions of terms for gypsum board assemblies not defined in this Section or in other referenced standards.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated. Include printed statement of VOC content for sealants.
- C. Shop Drawings: Show locations, fabrication, and installation of control and expansion joints including plans, elevations, sections, details of components, and attachments to other units of Work.
  - 1. Firestopping: For each joint condition where fire-rated walls and partitions interface other walls, floors, structural members or other building structure, provide UL firestop system description and drawing. Show each kind of construction condition and relationships to adjoining construction. Indicate which firestop materials will be used where and thickness for different hourly ratings. Include UL firestop design designation that evidences compliance with requirements for each condition.

#### 1.5 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For gypsum board assemblies with fire-resistance ratings, 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 UL's "Fire Resistance Directory.," GA-600, "Fire Resistance Design Manual.," or in listing of another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Deflection Firestop Track: Top runner indicated in fire-resistance-rated assemblies shall be labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages, containers, or 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 to on leveled supports off floor or slab prevent sagging.

## 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Establish and maintain environmental conditions for applying and finishing gypsum board to 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.
- D. Room Temperatures: For nonadhesive attachment of gypsum board to framing, maintain not less than 40 deg F. For adhesive attachment and finishing of gypsum board, maintain not less than 50 deg F for 48 hours before application and continuously after until dry. Do not exceed 95 deg F when using temporary heat sources.
- E. Ventilation: Ventilate building spaces as required to dry joint treatment materials. Avoid drafts during hot, dry weather to prevent finishing materials from drying too rapidly.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
  1. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.
  2. Products: Subject to compliance with requirements, provide one of the products specified.

## 2.2 STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Components, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Manufacturers:
    - a. Clark Western Building Systems.
    - b. Dale Industries, Inc. - Dale/Incor.
    - c. Dietrich Industries, Inc.
    - d. MarinoWare; Division of Ware Industries.
    - e. National Gypsum Company.
- B. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, not less than 0.162-inch-diameter (8-gage) wire, or double strand of not less than 0.099-inch- diameter (12-gage) wire.
- C. Hanger Attachments to Concrete: As follows:
  - 1. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by a qualified independent testing agency.
- D. Hangers: As follows:
  - 1. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.162-inch (8-gage) diameter.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base metal thickness of 0.0538 inch, a minimum 1/2-inch- wide flange, with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
  - 1. Depth: 2 inches.
- F. Furring Channels (Furring Members): Commercial-steel sheet with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
  - 1. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
    - a. Minimum Base Metal Thickness: **0.0312 inch** (22 gage).
- G. Grid Suspension System for Interior Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock, heavy-duty.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Furring Systems/Drywall.
    - b. Chicago Metallic Corporation; Drywall Furring 640 System.
    - c. USG Interiors, Inc.; Drywall Suspension System.
    - d. Provide comparable system where fire-rated ceilings are indicated.

## 2.3 STEEL PARTITION AND SOFFIT FRAMING

- A. Manufacturers:
  - 1. Clark Western Building Systems.
  - 2. Dale Industries, Inc. - Dale/Incor.
  - 3. Dietrich Industries, Inc.
  - 4. MarinoWare; Division of Ware Industries.
  - 5. National Gypsum Company.

- B. Components, General: As follows:
1. Comply with ASTM C 754 for conditions indicated.
  2. Steel Sheet Components: Complying with ASTM C 645 requirements for metal and with ASTM A 653/A 653M, G40, hot-dip galvanized zinc coating.
- C. Steel Studs and Runners: ASTM C 645.
1. Minimum Base Metal Thickness: 0.027 inch (22gage) minimum, unless otherwise indicated.
    - a. Provide studs with 0.0329 inch (20-gage) minimum thickness at the following locations:
      - 1) For 6 inch or greater framing.
      - 2) Jamb studs for door openings.
      - 3) Where indicated.
  2. Depth: As indicated.
  3. Maximum Allowable Deflection: Increase metal thickness where required to meet the following:
    - a. Maximum Allowable Deflection for Drywall Assemblies:  $L/240$  calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
    - b. Maximum Allowable Deflection for Drywall Assemblies Receiving Tile:  $L/360$  calculated using a 5 pound per square uniform load perpendicular to studs and based on stud properties alone.
- D. Deep-Leg Deflection Track: ASTM C 645 top runner with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
- E. Firestop Deflection Track: 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 not less than indicated for studs and in width to accommodate depth of studs. Provide deflection track with flanges to allow for 3/4-inch deflection at floors and 1-1/2 inch at roofs.
1. Product: Fire Trak Corp.; Fire Trak attached to studs with Fire Trak Slip Clip.
- F. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
1. Minimum Base Metal Thickness: **0.0598 inch** (16-gage), unless indicated otherwise.
- G. Cold-Rolled Channel Bridging: 0.0538-inch (16-gage) minimum bare steel thickness, with minimum 1/2-inch- wide flange.
1. Depth: 1-1/2 inches.
  2. Clip Angle: 1-1/2 by 1-1/2 inch, 0.068-inch- thick, galvanized steel.
- H. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
1. Minimum Base Metal Thickness 0.0312 inch (20 gage).
  2. Depth: 7/8 inch, unless otherwise indicated.
- I. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
- J. Configuration: Asymmetrical or hat shaped, with face attached to two flanges by slotted or expanded metal legs 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 0.027 inch (22gage), and depth as indicated.

- K. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members to substrates involved; complying with recommendations of gypsum board manufacturers for applications indicated.

## 2.4 INTERIOR GYPSUM WALLBOARD

- A. Manufacturers:
  - 1. G-P Gypsum Corporation.
  - 2. National Gypsum Company.
  - 3. United States Gypsum Company.
- B. Panel Size: Provide in maximum lengths and widths available that will minimize joints in each area and correspond with support system indicated.
- C. Gypsum Wallboard, GPDW: ASTM C 36.
  - 1. Type X:
    - a. Thickness: 5/8 inch.
    - b. Long Edges: Tapered.
    - c. Face Sheets: 100 percent post-consumer recycled content.
    - d. Location: All locations, except as otherwise noted.
- D. Moisture- and Mold-Resistant Type, MR GPDW: ASTM C 630 with moisture- and mold-resistant core and surfaces.
  - 1. Core: 5/8 inch, Type X.
  - 2. Long Edges: Tapered.
  - 3. Mold-Resistance: ASTM D3273, rating of 10.
  - 4. Face Sheets: 100 percent post-consumer recycled content.
  - 5. Location: Interior face of all exterior walls, and where indicated.

## 2.5 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047, galvanized steel.
  - 1. Shapes:
    - a. Cornerbead: 1-1/4 inch x 1-1/4 inch external corner with 1/8-inch nose bead. Use at outside corners, unless otherwise indicated.
    - b. LC-Bead (Casing): J-shaped casing with 1/16-inch nose bead ground, not less than 30 gage; exposed long flange receives joint compound; use at exposed panel edges.
    - c. Expansion (Control) Joint: One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
- B. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Fry Reglet Corp.
    - b. Gordon, Inc.
    - c. MM Systems Corporation.
    - d. 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. Profiles: As indicated. Provide end caps where trim terminates at door frames and other open locations.

## 2.6 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.
- B. Joint Tape:
  1. Interior Gypsum Wallboard: Paper reinforcing tape. Fiberglass tape not permitted.
- C. Setting-Type Joint Compound: Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.
  1. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.
- D. Drying-Type Joint Compound: Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.
  1. Ready-Mixed Formulation: Factory-mixed product.
- E. Type of 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, 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 or drying-type, all-purpose compound.
  3. Fill Coat: For second coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping compound or drying-type, all-purpose compound.

## 2.7 ACOUSTICAL SEALANT

- A. Products:
  1. Acoustical Sealant for Exposed and Concealed Joints:
    - a. Pecora Corp.; AC-20 FTR Acoustical and Insulation Sealant.
    - b. United States Gypsum Co.; SHEETROCK Acoustical Sealant.
  2. Acoustical Sealant for Concealed Joints:
    - a. Ohio Sealants, Inc.; Pro-Series SC-175 Acoustical Sound Sealant.
    - b. Pecora Corp.; AIS-919.
    - c. Tremco, Inc.; Tremco Acoustical Sealant.
- B. Acoustical Sealant for Exposed and Concealed Joints: Nonsag, paintable, nonstaining, latex sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), complying with ASTM C 834 that effectively reduces airborne

sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

- C. Acoustical Sealant for Concealed Joints: Nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber sealant, with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24), recommended for sealing interior concealed joints to reduce airborne sound transmission.

## 2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  - 1. Fastening gypsum board to steel members: Type S bugle head.
- C. Sound Attenuation Blankets (Acoustical Insulation): 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Certainteed.
    - b. Owens Corning.
    - c. Johns Manville.
- D. Thermal Insulation: As specified in Division [0]7 Section "Building Insulation."
- E. Insulation Support Anchors: Continuous, galvanized metal support strip, 25 gage, with pre-punched tabs at 8 inches on center.
  - 1. Product: Insul-hold; Insul-Hold Co., Inc.; phone (207) 465-9066.
- F. Polyethylene Vapor Retarder: ASTM D 4397, 6 mils thick, with maximum permeance rating of 0.13 perm.
- G. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.
- H. Firestopping: See Division 07 Section "Through-Penetration Firestop Systems." Provide firestopping where fire rated gypsum board assemblies butt masonry, steel deck, joists, beams, and structural members as part of the gypsum board assembly work. Penetrations through fire-resistance-rated walls and partitions by Division 26 work, including both empty openings and openings containing cables, pipes, ducts and conduits are specified as part of the Division 26 work.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance.
- 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.
- D. Post-Installation Inspection: Inspect walls for dents and imperfections, with Installer and painter present, prior to painting. Verify exposed joints are finished up to required heights (to above acoustical ceilings). Inspect wall again after primer and first coat of paint applied, with Installer and painter present. Installer shall touch-up as follows:
  - 1. Touch-up visible gypsum board imperfections before priming of walls.
  - 2. Touch-up imperfections found in field of boards and joints made visible from painting after first finish coat applied.
  - 3. Joint compound touch-up shall be primed and painted before final coat is applied and viewed for acceptability.

### 3.2 PREPARATION

- A. Suspended Ceilings: Coordinate installation of ceiling suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers at spacing required to support ceilings and that hangers will develop their full strength.

### 3.3 INSTALLING STEEL FRAMING, GENERAL

- A. Installation Standards: ASTM C 754, and ASTM C 840 requirements that apply to framing installation.
- B. Install supplementary framing, blocking, and bracing at terminations in gypsum board assemblies to support fixtures, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with gypsum board manufacturer's written recommendations or, if none available, with United States Gypsum's "Gypsum Construction Handbook."
- C. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.
  - 1. Isolate ceiling assemblies where they abut or are penetrated by building structure.
  - 2. Isolate partition framing and wall furring where it abuts structure, except at floor. Install slip-type joints at head of assemblies that avoid axial loading of assembly and laterally support assembly.
    - a. Allow for 3/4-inch deflection at floors and 1-1/2 inches at roofs.
    - b. Install deflection track top runner or deflection brackets to attain lateral support and avoid axial loading.
    - c. Install deflection firestop track top runner at fire-resistance-rated assemblies.
      - 1) Attach jamb studs at openings to tracks using manufacturer's standard stud clip.



- D. Do not bridge building control and expansion joints with steel framing or furring members. Frame both sides of joints independently.

### 3.4 INSTALLING STEEL SUSPENDED CEILING AND SOFFIT FRAMING

- A. Suspend ceiling 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 ceiling suspension system. 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 the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.
  - 3. Wire Hangers: Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eyescrews, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail.
  - 4. Do not attach hangers to steel roof deck.
  - 5. Do not support ceilings directly from permanent metal forms. Attach hangers to structural members.
  - 6. Do not attach hangers to steel deck tabs. Attach hangers to structural members.
  - 7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- B. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- C. Installation Tolerances: Install steel framing components for suspended ceilings so members for panel attachment are level to within **1/8 inch in 12 feet** measured lengthwise on each member and transversely between parallel members.
- D. Sway-brace suspended steel framing with hangers used for support.
- E. Wire-tie furring channels to supports, as required to comply with requirements for assemblies indicated.
- F. Install suspended steel framing components in sizes and spacings indicated, but not less than that required by the referenced steel framing and installation standards.
  - 1. Hangers: 48 inches o.c.
  - 2. Carrying Channels (Main Runners): 48 inches o.c.
  - 3. Furring Channels (Furring Members): 16 inches o.c.
- G. Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
  - 1. Fire-Rated Ceilings:
    - a. Butt Joints: Provide extra cross tees spaced 8 inches or less on either side of butt joints.
    - b. Fire Relief Notch: Provide a hanger wire installed adjacent to fire relief notch.

### 3.5 INSTALLING STEEL PARTITION AND SOFFIT FRAMING

- A. Install tracks (runners) at floors, ceilings, and structural walls and columns where gypsum board assemblies abut other construction.
- B. Installation Tolerance: Install each steel framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by the faces of adjacent framing.
- C. Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board.
  - 1. Cut studs 1/2 inch short of full height to provide perimeter relief. Do not fasten studs to top track to allow independent movement of studs and track.
  - 2. For fire-resistance-rated partitions that extend to the underside of floor/roof slabs and decks or other continuous solid-structure surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed to support gypsum board closures and to make partitions continuous from floor to underside of solid structure.
- D. Install steel studs and furring at the following spacings:
  - 1. Single-Layer Construction: 16 inches o.c., unless otherwise indicated.
- E. Install steel studs so flanges point in the same direction and leading edge or end of each panel can be attached to open (unsupported) edges of stud flanges first.
  - 1. Attach both flanges to floor runner track with screws.
- F. Frame door openings to comply with GA-600 and with gypsum board manufacturer's applicable written recommendations, unless otherwise indicated. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
  - 1. Install two studs at each jamb, unless otherwise indicated.
  - 2. 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.
  - 3. Extend jamb studs through suspended ceilings and attach to underside of floor or roof structure above, even when partitions are not full height. Provide diagonal bracing at tall partitions to stop deflection and vibration of studs when doors are slammed shut.
  - 4. Extend jamb studs one-piece full height.
- G. 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.
- H. Z-Furring Members:
  - 1. Install Z-furring members horizontally 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 INSTALLATION OF ACOUSTICAL INSULATION

- A. Install acoustical insulation at locations indicated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement.
- B. Install a single layer of insulation of required thickness to fill the full depth of cavity, unless otherwise shown. Where cavity requires insulation that is thicker than standard size, install next larger size and compress into cavity.
- C. Hold batt insulation in place with insulation support anchors located at 5 feet on center, full height of wall, starting at the top of each stud space.
- D. Stuff glass fiber loose fill insulation into miscellaneous voids and cavity spaces. Fill box headers, and voids while framing is being erected that will be inaccessible for installation later. Compact to approximately 40 percent of normal maximum volume (to a density of approximately 2.5 pcf).

### 3.7 APPLYING AND FINISHING PANELS, GENERAL

- A. Gypsum Board Application and Finishing Standards: ASTM C 840 and GA-216, except as specified otherwise.
- B. Install acoustical insulation, where indicated, before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.
- C. Install ceiling board panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- D. Install gypsum 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.
- E. 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.
- F. Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- G. Attach gypsum panels to framing provided at openings and cutouts.
- H. Form control and expansion joints with space between edges of adjoining gypsum panels.
  - 1. Where control joints are not shown, provide control joints at a maximum spacing of 30 feet; review proposed locations with Architect prior to installation.
- I. Cover both faces of steel stud partition 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. Caulk smoke partitions to prevent the passage of smoke.
- J. Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with casing bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- K. Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's written recommendations.
1. Space screws a maximum of 12 inches o.c. for vertical applications.
- L. Space fasteners in panels that are tile substrates a maximum of 8 inches o.c.
- M. Remove screws that do not hit studs, supports, or blocking.

### 3.8 PANEL APPLICATION METHODS

- A. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of board.
  3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
- B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

### 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. Install corner bead at external corners.
- C. Install edge trim where edge of gypsum panels would otherwise be exposed. Provide edge trim type with face flange formed to receive joint compound, except where other types are indicated.
1. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.
  2. Install L-bead where edge trim can only be installed after gypsum panels are installed.
  3. Install U-bead where indicated.
- D. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

- E. Aluminum Trim: Install in locations indicated on Drawings.

### 3.10 FINISHING GYPSUM BOARD ASSEMBLIES

- A. General: Treat gypsum board joints, interior angles, flanges of corner bead, 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, beveled edges, and damaged surface areas using setting-type joint compound.
- C. Apply joint tape over gypsum board joints and to flanges of trim accessories, except those with trim having flanges not intended for tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below, according to ASTM C 840, for locations indicated:
  - 1. Level 1: At ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistance-rated assemblies.
  - 2. Level 2: At ceiling plenum areas, concealed areas, and where indicated, for fire-resistance-rated assemblies, smoke assemblies and sound-rated assemblies.
  - 3. Level 2: Where panels are substrate for tile and where indicated.
  - 4. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
- E. Where Level 1 gypsum board finish is indicated, embed tape in joint compound. Surface shall be free of excess joint compound.
- F. Where Level 2 gypsum board finish is indicated, fill fastener heads, embed tape in joint compound and apply thin coat of joint compound over all joints and interior angles.
- G. For Level 4 gypsum board finish, embed tape in joint compound and apply first, fill (second), and finish (third) coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration.
  - 1. At tapered edge joints, draw compound down to a level plane, leaving a monolithic surface that is flush with the paper face. Finish coat shall be feathered a minimum of 8 inches beyond both sides of center of joint tape.
  - 2. At end-to-end butt joints, draw compound down to minimize hump created by joint tape application. Finish coat shall be feathered a minimum of 16 inches beyond both sides of center of joint tape.
  - 3. End product shall be a surface that appears level without telegraphing joint locations as high spots when viewed down wall after painting.
  - 4. Finish board to within 1/4 inch of floor, providing full support for resilient wall base without telegraphing joint.

### 3.11 FIELD QUALITY CONTROL

- A. Above-Ceiling Observation: Before Contractor installs gypsum board ceilings, Architect will conduct an above-ceiling observation and report deficiencies in the Work observed. Do not proceed with installation of gypsum board to ceiling support framing until deficiencies have been corrected.

1. Notify Architect seven days in advance of date and time when Project, or part of Project, will be ready for above-ceiling observation.
2. Before notifying Architect, complete the following in areas to receive gypsum board ceilings:
  - a. Installation of 80 percent of lighting fixtures, powered for operation.
  - b. Installation, insulation, and leak and pressure testing of water piping systems.
  - c. Installation of air-duct systems.
  - d. Installation of air devices.
  - e. Installation of mechanical system control-air tubing.
  - f. Installation of above ceiling automatic fire suppression piping, including leak and pressure testing.
  - g. Installation of ceiling support framing.

### 3.12 CLEANING AND PROTECTION

- A. Promptly remove any residual joint compound from adjacent surfaces.
- B. Provide final protection and maintain conditions, in a manner acceptable to Installer, that ensures gypsum board assemblies are without damage or deterioration at time of Substantial Completion.

END OF SECTION 092950

## SECTION 095113 - ACOUSTICAL PANEL CEILINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Acoustical panels.
  - 2. Exposed suspension systems.
  - 3. Acoustical Batt Insulation
- B. Related Sections include the following:
  - 1. Division 21, 22, 23 and 26 Sections for coordination of air handling devices, fire protection devices, and electrical devices installed in ceiling systems.

#### 1.3 DEFINITIONS

- A. CAC: Ceiling Attenuation Class.
- B. NRC: Noise Reduction Coefficient.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes. Store materials flat.
- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

#### 1.6 PROJECT CONDITIONS

- A. Mechanical, electrical, and other utility service installations above the ceiling plane shall have been completed prior to the installation of the ceilings.

## 1.7 COORDINATION

- A. Coordinate layout and installation of acoustical panels and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

## PART 2 - PRODUCTS

### 2.1 ACOUSTICAL PANELS, GENERAL

- A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
  - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
  - 2. Test Method for Ceiling Attenuation Class (CAC). Where acoustical panel ceilings are specified to have a CAC, provide units identical to those tested per ASTM E 1414 by a qualified testing agency.
- B. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.

### 2.2 ACOUSTIC PANELS

- A. Acoustic Panel: ACT-1.
  - 1. Size: 24 inches x 24 inches by 5/8-inch thick.
  - 2. Composition: Mineral wool fiber.
  - 3. Surface Finish: Factory-applied latex paint; white.
  - 4. Surface Texture: Medium.
  - 5. Edge: Angled tegular.
  - 6. NRC Range: .55.
  - 7. CAC Range: 33.
  - 8. Fire Hazard Classification: Class A, 0 - 25 flame spread.
  - 9. Dimensional Stability: Sag resistant at high humidity.
  - 10. Antimicrobial Treatment: Coating based, front and back.
  - 11. Product: Armstrong World Industries, Inc.; Cortega #704.

### 2.3 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.
- B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.
- C. Attachment Devices: Size for five times the design load indicated in ASTM C 635, Table 1, "Direct Hung," unless otherwise indicated.
  - 1. 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.

- D. 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-inch**- diameter wire.

## 2.4 METAL SUSPENSION SYSTEMS FOR ACOUSTICAL PANEL CEILINGS

- A. Wide-Face, Capped, Double-Web, Steel Suspension System: Main and cross runners roll formed from cold-rolled steel sheet, prepainted, electrolytically zinc coated, or hot-dip galvanized according to ASTM A 653/A 653M, not less than **G30** coating designation, with prefinished **15/16-inch**- wide metal caps on flanges.
1. Structural Classification: Intermediate-duty system.
  2. End Condition of Cross Runners: Override (stepped) or butt-edge type, as standard with manufacturer.
  3. Face Design: Flat, flush.
  4. Cap Material: Steel or aluminum cold-rolled sheet, as standard with manufacturer.
  5. Cap Finish: Painted white.
  6. Product: Armstrong World Industries, Inc.; Prelude Exposed Tee System, 7300 Series.

## 2.5 ACOUSTICAL BATT INSULATION

- A. Acoustical Batt Insulation: ASTM C 665, Type I (blankets without membrane facing) used as acoustical insulation.
1. Install R30 (9 1/2") unfaced insulation above suspended ceilings as indicated on drawings.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Certainteed.
    - b. Owens Corning.
    - c. Johns Manville.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

### 3.3 INSTALLATION, GENERAL

- A. General: Install acoustical panel ceilings to comply with ASTM C 636 and seismic requirements indicated, per manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
  - 1. Hangers shall be single lengths of wire without splices; coordinate lengths in deep ceiling cavities.
  - 2. 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.
  - 3. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  - 4. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
  - 5. 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.
  - 6. Do not support ceilings directly from permanent metal forms. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
  - 7. Do not attach hangers to steel deck tabs.
  - 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
  - 9. Space hangers not more than **48 inches** o.c. along each member supported directly from hangers, unless otherwise indicated; provide hangers not more than **8 inches** from ends of each member.
  - 10. Exposed pop rivets for grid alignment purposes shall not be permitted.
- C. Suspension system shall be reinforced to support diffusers, light fixtures and any additional members. Install hanger wires to grid at each corner of light fixtures. Coordinate location with electrical and other trades.
  - 1. Each individual fixture and attachment with combined weight of 56 pounds or less shall have two 12-gage wire hangers attached at diagonal corners of the fixture. These wires shall be slack. Fixtures and attachments with a combined weight of greater than 56 pounds shall be independently supported from the structure at all four corners.
- D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. 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.
  2. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- E. Install suspension system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- F. Install acoustical panels with undamaged edges and fit accurately into suspension system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels to run in the same direction.
  2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.
  3. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

### 3.4 INSTALLATION OF DECORATIVE ALUMINUM TRIM

- A. General: Install in accordance with the manufacturer's written instructions.

### 3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

## SECTION 096500 - RESILIENT FLOORING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Vinyl composition tile (VCT).
  - 2. Resilient wall base, reducer strips, and other accessories.
  - 3. Independent testing of concrete.
- B. Related Sections include the following:
  - 1. Division 02 Section "Selective Demolition and Alterations" for removing existing finishes.

#### 1.3 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each type of product indicated. Include printed statement of VOC content for adhesives.
- C. Samples: For each type of product indicated. Samples shall be in form of manufacturer's color charts consisting of the following:
  - 1. Floor Tile: Actual tiles or section of tiles showing full range of colors and patterns available.
  - 2. Resilient Accessories: Color charts consisting of strips of resilient base showing the full range of colors available for each product exposed to view.
- D. Product Certifications: Signed by resilient flooring manufacturer of products supplied that products comply with specifications and local regulations controlling use of volatile organic compounds (VOC's).
  - 1. Flooring manufacturers shall certify that proposed adhesives are acceptable for use with each type of floor covering.
- E. Maintenance Data: For resilient products to include in maintenance manuals.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver resilient flooring materials and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing name of product and manufacturer, Project identification, and shipping and handling instructions.
- B. 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 and rolls upright.

- C. Move flooring materials and accessories and installation products into spaces where they will be installed at least 48 hours in advance of installation. Do not install flooring materials until they are at same temperature as space where they are to be installed.

## 1.5 PROJECT CONDITIONS

- A. Maintain ambient and substrates temperatures within range recommended by manufacturer, but not less than **70 deg F** or more than **85 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 post-installation period, maintain temperatures within range recommended by manufacturer, but not less than **55 deg F** or more than **95 deg F**.
- C. Close spaces to traffic during floor covering installation and for 48 hours after floor covering installation.

## 1.6 SEQUENCING AND SCHEDULING

- A. Install resilient products after other finishing operations, including painting, have been completed.
- B. Contractor to coordinate project schedule to complete work by other trades and vacate areas receiving floor coverings, stopping pedestrian traffic over newly installed flooring until curing and drying period is complete. Contractor to conduct periodic coordination meetings with all trades to review schedule and procedures to prevent interference and damage during installation and curing and drying periods of floor coverings.

## 1.7 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Floor Tile Furnish 1 box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed. Resilient Wall Base and Accessories: Furnish not less than **10 linear feet** for every **500 linear feet** or fraction thereof, of each type, color, pattern, and size of resilient product installed.

## PART 2 - PRODUCTS

### 2.1 VINYL COMPOSITION TILE

- A. Vinyl Composition Tile, VCT-1: ASTM F 1066.
  - 1. Product: Mannington Mills, Inc.; Solidpoint.
  - 2. Class: 2 (through-pattern tile).
  - 3. Wearing Surface: Smooth.
  - 4. Thickness: **0.125 inch**.
  - 5. Size: **12 by 12 inches**.
  - 6. Colors: As indicated in Materials Legend.
  - 7. Fire-Test-Response Characteristics:

- a. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm per ASTM E 648.

## 2.2 RESILIENT WALL BASE

- A. Wall Base, RWB-1: ASTM F 1861.
  - 1. Manufacturers: Rubber Wall Base; Johnsonite.
- B. Type (Material Requirement): TS (rubber, vulcanized thermoset).
- C. Group (Manufacturing Method): I (solid).
- D. Style: Cove (with top-set toe) at resilient flooring and straight (toeless) at carpet.
- E. Minimum Thickness: 0.125 inch.
- F. Height: 4 inches.
- G. Lengths: Coils in manufacturer's standard length.
- H. Outside Corners: Job formed.
- I. Inside Corners: Job formed.
- J. Surface: Smooth.
- K. Color: As indicated in Materials Legend.

## 2.3 RESILIENT MOLDING ACCESSORY

- A. Manufacturer: Johnsonite.
- B. Material: Vinyl.
- C. Transition Strips: The following product identification numbers are for products manufactured by Johnsonite. Provide listed products or equal from one of listed manufacturers.
  - 1. Carpet to Resilient: No. CTA-XX-D.
  - 2. Resilient to Concrete: No. RRS-XX-C.
  - 3. Carpet to Concrete: No. EG-XX-G.

## 2.4 INSTALLATION MATERIALS

- A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.
- B. 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.
- C. Adhesives: Premium grade, water-resistant type acceptable to manufacturer to suit resilient products and substrate conditions indicated.
  - 1. Provide spray adhesive for VCT.

2. VOC Limits: Provide adhesives that comply with the following limits for VOC content when tested according to ASTM D 5116:
  - a. Total VOCs: 10.00 mg/sq. m x h.
  - b. Formaldehyde: 0.05 mg/sq. m x h.
  - c. 2-Ethyl-1-Hexanol: 3.00 mg/sq. m x h.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, 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.
- B. If conditions detrimental to work are encountered, prepare written report, signed by Installer, documenting unsatisfactory conditions and send to the Architect.
- C. 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: Verify that concrete slabs comply with ASTM F 710 and the following:
  1. Verify that substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by flooring manufacturer, and with the specified requirements.
  2. An independent testing agency shall perform calcium chloride moisture tests, relative humidity test, alkalinity tests, and adhesion test. Testing shall be conducted as follows:
    - a. Maintain a minimum temperature of **70 deg F** in spaces to receive flooring for at least 72 hours prior to and during the tests.
    - b. Perform the tests at rate of not less than 1 test/1000 sq. ft. of floor area for slabs-on-grade and 1 test/ 2000 sq. ft. of floor area for elevated slabs.
    - c. Perform tests on both new and existing slabs.
  3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
  4. Moisture Testing: Perform tests in accordance with recommendation of flooring manufacturer and the following specified requirements:
    - a. Anhydrous Calcium Chloride Moisture Tests: Perform in accordance with ASTM F 1869, except tests shall not deduct area of CaCl<sub>2</sub> dish.
    - b. Relative Humidity Test: Perform test using in situ probes, ASTM F 2170.
  5. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of **3 lb of water/1000 sq. ft.** in 24 hours, a maximum 75% relative humidity level measurement, and meet manufacturer's requirements for relative humidity and alkalinity and adhesion.

- 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. Existing Floor Slabs: Scrape and remove adhesive from floor where existing floor covering are removed. Trowel apply underlayment compound over entire floor to smooth substrate surface and prevent telegraphing of surface irregularities. Level and smooth over trench cut areas to prevent telegraphing of trench cut and patching through finish flooring.
- E. Existing Tile Floor Substrate: Where resilient floor coverings are indicated to be installed over existing tile flooring, shot blast tile floor to profile tile and to remove all protective floor coatings that contain soap, wax, oil, or silicone. Do not use solvents. Trowel apply underlayment compound over entire floor to smooth substrate surface and prevent telegraphing of surface irregularities.
- F. Use trowelable leveling and patching compound to fill cracks, holes, saw cuts, and depressions in substrates.
- 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 RESILIENT FLOOR COVERING INSTALLATION, GENERAL

- A. Install in accordance with floor covering manufacturer's written instructions and requirements of this Section.
- B. Scribe, cut, and fit floor covering to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, edgings, door frames, thresholds, and nosings.
- C. Extend floor covering into toe spaces, door reveals, closets, and similar openings.
- D. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor covering as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- E. Adhere floor coverings to 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 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. Install tiles square with room axis, unless otherwise 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.
  - 1. Verify pattern and grain direction with Architect prior to installation.
- C. 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.
- D. Hand roll tiles where required by tile manufacturer.

### 3.5 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. Provide on fronts and exposed sides and backs of floor-mounted casework. Where toe space is less than base height, cut down base to proper height.
- 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. Job-Formed Corners: Provide job-formed corners everywhere, except as noted, as follows:
  - 1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends. Shave back of base at points where bends occur and remove strips perpendicular to length of base that are only deep enough to produce a snug fit without removing more than half the wall base thickness.
  - 2. Inside Corners: Use straight pieces of maximum lengths possible. Form by cutting an inverted V-shaped notch in toe of wall base at the point where corner is formed. Shave back of base where necessary to produce a snug fit to substrate.
  - 3. Adhere base to substrate with contact adhesive 12 inches each side of outside corner to properly hold base in permanent proper position in tight contact with wall. Base shall run continuous around corners with butt joints 12 inches minimum for corner.

### 3.6 RESILIENT ACCESSORY INSTALLATION

- A. 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.

### 3.7 CLEANING AND PROTECTION

- A. Perform the following operations immediately after completing installation of resilient floor coverings and accessories:
  - 1. Remove adhesive and other blemishes from exposed surfaces using cleaner recommended by resilient floor coverings manufacturers.
  - 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.
  - 4. Not more than 7 days after completion of installation, apply 1 coat of sealer/wax to a clean, dry floor covering per manufacturer's requirements, protecting surface with uniform coating and gloss. Work shall be done by a floor care subcontractor.
  
- 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 manufacturers.
    - a. Coordinate selection of floor polish with 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.
  
- C. Final cleaning, polishing and buffing specified in Division 1 Section "Closeout Procedures."

END OF SECTION 096500

## SECTION 099000 - PAINTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exposed interior items and surfaces with low VOC coatings complying with ME DEP regulations.
  - 2. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.
- B. Related Sections include the following:
  - 1. Division 05 Section "Metal Fabrications" for shop priming ferrous metal.
  - 2. Division 06 Section "Finish Carpentry" for surface preparation of interior finish carpentry.
  - 3. Division 08 Section "Steel Frames" for factory priming steel frames.
  - 4. Division 08 Section "Clad Wood Windows" for surface preparation of interior surface of windows.
  - 5. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
  - 6. Review all sections for shop primed items requiring field painting.

#### 1.3 DEFINITIONS

- A. General: Standard coating terms defined in ASTM D 16 apply to this Section.
  - 1. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.
  - 2. Eggshell refers to low-sheen finish with a gloss range between 20 and 35 when measured at a 60-degree meter.
  - 3. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.
  - 4. Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 when measured at a 60-degree meter.
  - 5. Full gloss refers to high-sheen finish with a gloss range more than 70 when measured at a 60-degree meter.

#### 1.4 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: For each paint system indicated, including block fillers and primers.
  - 1. Material List: An inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

2. Manufacturer's Information: Manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
  3. Include printed statement of VOC content for each product.
- C. Schedule: Provide schedule of all surfaces to be coated, with prime and finish coat material listed, and manufacturer's recommended wet film thickness.

## 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain block fillers, primers and undercoat materials for each coating system from the same manufacturer as the finish coats.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Benjamin Moore & Company (Moore).
  2. ICI Dulux Paints (ICI).
  3. PPG Architectural Finishes, Inc. (PPG).
  4. Sherwin-Williams Co. (S-W).

### 2.2 COATINGS MATERIALS, GENERAL

- A. Material Compatibility: Provide block fillers, primers, undercoats, 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 coating 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.
- C. VOC Compliance for Interior Paints and Coatings: Provide the manufacturer's formulation for the products specified below that are VOC compliant with the State of Maine Department of Environmental Protection Regulation, "Chapter 151: Architectural and Industrial Maintenance (AIM) Coatings" and the following chemical restrictions expressed in grams per liter:
1. Flat Paints and Coatings: VOC content of not more than 100 g/L.
  2. Non-Flat Paints and Coatings: VOC content of not more than 150 g/L.
  3. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
  4. Industrial Maintenance Coatings (IMC): VOC content of not more than 340 g/L.
  5. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
  6. Quick-Dry Enamels: VOC content of not more than 250 g/L.
  7. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
- D. Colors: Provide color selections made by the Architect.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, under which painting will be performed for compliance with paint application requirements.
  - 1. If unacceptable conditions are encountered, prepare written report, endorsed by Applicator, listing conditions detrimental to performance of work.
  - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  - 3. Application of coating indicates Applicator's acceptance of surfaces and conditions within a particular area.
  - 4. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
- 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 specified finish materials to ensure use of compatible primers.
  - 1. Notify Architect about anticipated problems when using the materials specified over substrates primed by others.

### 3.2 PREPARATION

- A. General: Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of size or weight of the item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.
- B. Cleaning: Before applying paint or other surface treatments, clean substrates of substances that could impair bond of the various coatings. Remove oil and grease before cleaning.
  - 1. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.
- C. Surface Preparation: Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.
  - 1. Provide barrier coats over incompatible primers or remove and reprime.
  - 2. Cementitious Materials: Prepare concrete unit masonry surfaces to be painted. Remove efflorescence, chalk, dust, dirt, grease, oils, and release agents. Roughen as required to remove glaze.
    - a. 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.
  - 3. Wood: Clean surfaces of dirt, oil, and other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sand surfaces exposed to view smooth and dust off.
    - a. Scrape and clean small, dry, seasoned knots, and apply a thin coat of white shellac or other recommended knot sealer before applying primer. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood filler. Sand smooth when dried.
    - b. Prime, stain, or seal wood to be painted immediately on delivery. Prime edges, ends, faces, undersides, and back sides of wood.
    - c. If transparent finish is required, backprime with spar varnish.

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. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.
    - b. Touch up bare areas and shop-applied prime coats that have been damaged. Clean with solvents recommended by paint manufacturer and SSPC SP2; and touch up with same primer as the shop coat.
  5. Galvanized Surfaces: Uniformly abrade galvanized surfaces with a palm sander and 60 grit aluminum oxide so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
    - a. Clean field welds with nonpetroleum-based solvents complying with SSPC's standards so surface is free of oil and surface contaminants.
- 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.

### 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 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 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 back sides of access panels and removable or hinged covers to match exposed surfaces.
  8. 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. Paint all exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Architect will select from standard colors and finishes available.
1. Painting includes field painting of exposed bare and covered pipes and ducts (including color-coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment at all locations except mechanical and electrical rooms.
- D. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.
1. Labels: Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code-required labels or equipment name, identification, performance rating, or nomenclature plates.
- E. Application Procedures: Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions. Walls shall have roller finish.
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.
- F. 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.
- G. Mechanical and Electrical Work: Painting of mechanical, plumbing, fire protection and electrical work is limited to items exposed in occupied spaces (outside mechanical and electrical rooms).
- H. Mechanical, plumbing, and fire protection items to be painted include, but are not limited to, the following:
1. Piping, pipe hangers and supports.
  2. Ductwork, including interior of ductwork visible through air devices.
  3. Insulation.
  4. Accessory items.
- I. Block Fillers: Apply block fillers to concrete masonry units at a rate to ensure complete coverage with pores filled.

- J. 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 to ensure a finish coat with no burn-through or other defects due to insufficient sealing.
- K. 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.
- L. Transparent (Clear or Stained) 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, unless otherwise noted.
- M. Stipple Enamel Finish: Roll and redistribute paint to an even and fine texture. Leave no evidence of rolling, such as laps, irregularity in texture, skid marks, or other surface imperfections.
- N. Completed Work: Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.
- O. Interior Ferrous Metal Items to Be Painted Include, but Are Not Limited To, the Following:
  - 1. Steel doors and frames.
  - 2. Handrails.
  - 3. Wood door glass lite kits.
  - 4. Access panels (both sides).
  - 5. Metal fabrications. See Section 05500.
  - 6. Miscellaneous metal items.

### 3.4 CLEANING

- A. Cleanup: At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the Project site.
  - 1. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

### 3.5 PROTECTION

- A. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Architect.
- B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.
  - 1. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.6 EXTERIOR PAINT SCHEDULE

- A. Wood Siding and Trim, Opaque Finish: Provide the following finish systems over smooth wood siding and other smooth, exterior wood surfaces:



1. Low-Luster Acrylic Finish: 2 finish coats over a primer.
  - a. Primer: Exterior, alkyd or latex, wood primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
    - 1) Moore: Moorcraft Super Spec Alkyd Exterior Primer No. 176; 1.8 mils DFT.
    - 2) ICI: 2000-1200 Dulux Professional Exterior 100% Acrylic Latex Primer; 1.6 mils DFT.
    - 3) S-W: A-100 Exterior Latex Wood Primer B42W41; 1.4 mils DFT.
  - b. First and Second Coats: Low-sheen (eggshell or satin), exterior, latex paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
    - 1) Moore: Moorcraft Super Spec Low Lustre Latex House Paint No. 185; 2.0 mils DFT.
    - 2) ICI: 2402-XXXX Dulux Professional Exterior 100% Acrylic Satin Finish; 2.8 mils DFT.
    - 3) S-W: SuperPaint Exterior Latex Satin A89 Series; 3.0 mils DFT.
  
- B. PVC Trim: Provide the following finish systems over exterior PVC substrates:
  1. Semigloss, Acrylic-Enamel Finish: 2 finish coats.
    - a. First and Second Coats: Semigloss, waterborne, exterior, acrylic enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Moorcraft Super Spec 100% Acrylic Semi-Gloss Enamel 281; 2.2 mils DFT.
      - 2) ICI: Devflex 4205 Interior/Exterior Acrylic Latex Semi-Gloss Enamel; 3.6 mils DFT.
      - 3) S-W: SuperPaint Exterior Gloss Latex A84 Series; 3.0 mils DFT.
  
- C. Ferrous Metal: Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.
  1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.
    - a. Primer: Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Moore's IMC M04 Acrylic Metal Primer; 2.0 mils DFT.
      - 2) ICI: 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish; 2.2 mils DFT.
      - 3) S-W: DTM Acrylic Primer/Finish/ B66W1; 2.5 mils DFT.
      - 4) Tnemec: Tnemec Primer, Series 10; 2.0 mils DFT.
    - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Moore's IMC DTM M29 Acrylic Semigloss; 4.0 mils DFT.
      - 2) ICI: 4206-XXXX, Interior/Exterior Acrylic Semi-Gloss Enamel; 3.0 mils DFT.
      - 3) S-W: DTM Acrylic Coating Gloss (Waterborne) B66W200 Series; 5.0 mils DFT.
      - 4) Tnemec: Tnemec-Cryl SG, Series 7; 4.0 mils DFT.

- D. Zinc-Coated Metal: Provide the following finish systems over exterior zinc-coated (galvanized) metal surfaces:
1. Semigloss, Acrylic-Enamel Finish: 2 finish coats over a primer.
    - a. Primer: Metal primer applied to galvanized metals not previously shop-primed applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Moore's IMC Acrylic Metal Primer No. M04; 2.0 mils DFT.
      - 2) ICI: 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish; 2.5 mils DFT.
      - 3) S-W: Galvite HS Paint B50WZ30; 3.5 mils DFT.
      - 4) Tnemec: Tneme-Cryl, Series 6; 2.5 mils DFT.
    - b. First and Second Coats: Semigloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Moore's IMC DTM M29 Acrylic Semigloss; 8.0 mils DFT.
      - 2) ICI: 4206-XXXX, Interior/Exterior Acrylic Semi-Gloss Enamel; 8.0 mils DFT.
      - 3) S-W: DTM Acrylic Coating Gloss (Waterborne) B66W200 Series; 6.0 mils DFT.
      - 4) Tnemec: Tneme-Cryl SG, Series 7; 5.0 mils DFT.

### 3.7 INTERIOR COATINGS

- A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements in paragraph 2.02.C of this Section.
- B. Concrete Masonry Units: Provide the following finish systems over interior concrete masonry block units:
1. Low-Luster, Acrylic-Enamel Finish, Walls: 2 finish coats over a block filler.
    - a. Block Filler: High-performance, latex-based, block filler applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Latex Block Filler No. M88; 8.0 mils DFT.
      - 2) ICI: Bloxfil 4000-1000 Interior/Exterior Heavy Duty Acrylic Block Filler; 7.0 mils DFT.
      - 3) S-W: PrepRite Block Filler B25W25; 8.0 mils DFT.
    - b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: Moorcraft Super Spec Latex Eggshell Enamel No. 274; 2.6 mils DFT.
      - 2) ICI: 1412-XXXXN Ultrahide Eggshell Interior Wall & Trim Enamel; 2.8 mils DFT.
      - 3) S-W: ProGreen 200 Low VOC Interior Latex Flat B30-600 Series; 3.6 mils DFT.
- C. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
1. Flat Acrylic Finish, GPDW Ceilings: 2 finish coats over a primer.
    - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.

- 1) Moore: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253; 1.2 mils DFT.
  - 2) ICI: 1000-1200, Prep & Prime Hi-Hide Wall Interior Water-Based Primer Sealer; 1.9 mils DFT.
  - 3) S-W: ProGreen 200 Low VOC Interior Latex Primer B28W600 Series; 1.5 mils DFT.
- b. First and Second Coats: Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
- 1) Moore: Moorecraft Super Spec Latex Flat No. 275; 2.4 mils DFT.
  - 2) ICI: 1210-XXXX, Ultrahide Interior Flat Latex Wall & Trim Finish; 2.8 mils DFT.
  - 3) S-W: ProGreen 200 Low VOC Interior Latex Primer B28W600 Series; 1.5 mils DFT.
2. Low-Luster (Eggshell), Acrylic-Enamel Finish, Walls: 2 finish coats over a primer.
- a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
- 1) Moore: Moorcraft Super Spec Latex Enamel Undercoater & Primer Sealer No. 253; 1.2 mils DFT.
  - 2) ICI: 1000-1200, Prep & Prime Hi-Hide Wall Interior Water-Based Primer Sealer; 1.9 mils DFT.
  - 3) S-W: ProGreen 200 Low VOC Interior Latex Primer B28W600 Series; 1.5 mils DFT.
- b. First and Second Coats: Low-luster (eggshell or satin), acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
- 1) Moore: Moorcraft Super Spec Latex Eggshell Enamel No. 274; 2.6 mils DFT.
  - 2) ICI: 1210-XXXX, Ultrahide Interior Flat Latex Wall & Trim Finish ; 2.8 mils DFT.
  - 3) S-W: ProGreen 200 Low VOC Interior Latex Eg-Shel B20-600 Series; 3.4 mils DFT.

D. Woodwork, Opaque Finish: Provide the following paint finish systems over new, interior wood surfaces:

1. Semigloss, Acrylic-Enamel Finish (Opaque Trim): 2 finish coats over a wood undercoater.
  - a. Primer: Stain-blocking, acrylic-latex-based, interior wood undercoater, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
    - 1) Moore: Fresh Start All Purpose 100% Acrylic Primer No. 23; 1.3 mils DFT.
    - 2) ICI: 1030-1200, Ultra-Hide PVA Interior Primer-Sealer General Purpose Wall Primer; 1.9 mils DFT.
    - 3) S-W: ProGreen 200 Low VOC Interior Latex Primer B28W600 Series; 1.5 mils DFT.
  - b. First and Second Coats: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.

- 1) Moore: Moorcraft Super Hide Latex Semi-Gloss Enamel No. 283; **2.0 mils** DFT.
  - 2) ICI: 1406-XXXXN Dulux Pro Premium Acrylic Semi-Gloss Interior Wall & Trim Enamel; **3.0 mils** DFT.
  - 3) S-W: ProGreen 200 Low VOC Interior Latex Semi-Gloss Enamel B31-600 Series; **3.2 mils** DFT.
- E. Ferrous Metal: Provide the following finish systems over ferrous metal:
1. Semigloss, Acrylic-Enamel Finish: 2 IMC finish coats over a primer.
    - a. Primer: Quick-drying, corrosion resistant, acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: I.M.C. Acrylic Metal Primer M04; **2.0 mils** DFT.
      - 2) ICI: 4020-XXXX DTM Flat Interior/Exterior Waterborne Primer & Finish; **3.0 mils** DFT.
      - 3) S-W: IMC DTM Acrylic Primer/Finish, B66W1; 3.0 mils DFT.
    - b. First and Second Coats: IMC Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: IMC DTM M29 Acrylic Semigloss; **5.0 mils** DFT.
      - 2) ICI: IMC 4216-XXXXV High Performance Waterborne Acrylic Semi-Gloss Enamel; 8.0 mils DFT .
      - 3) S-W: IMC DTM Acrylic Coating Semi-Gloss (Waterborne) B66W200 Series; 7.0 mils DFT.
- F. Zinc-Coated Metal: Provide the following finish systems over zinc-coated metal:
1. Semigloss, Acrylic-Enamel Finish: 2 IMC finish coats over a primer.
    - a. Primer: Quick-drying, corrosion resistant, acrylic primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: IMC Acrylic Metal Primer M04; **2.0 mils** DFT.
      - 2) ICI: IMC 4020-XXXX DTM Flat Interior/Exterior Waterborne Primer & Finish; **3.0 mils** DFT.
      - 3) S-W: IMC DTM Acrylic Primer/Finish, B66W1; 3.0 mils DFT.
    - b. First and Second Coats: IMC Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
      - 1) Moore: IMC DTM M29 Acrylic Semigloss; **5.0 mils** DFT.
      - 2) ICI: IMC 4216-XXXXV High Performance Waterborne Acrylic Semi-Gloss Enamel; 8.0 mils DFT.
      - 3) S-W: IMC DTM Acrylic Coating Semi-Gloss (Waterborne) B66W200 Series; 7.0 mils DFT.
- G. Telecommunication and Electrical Backboards: Provide the following finish over plywood:
1. Flat Intumescent Finish: Two finish coats over a primer.
    - a. Primer: Latex-based, interior primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.

- 1) Moore: Pristine EcoSpec Interior Latex Primer Sealer 231; 0.8 mils DFT.
- 2) SW: Preprite Problock Primer\Sealer.
- b. First and Second Coats: Intumescent-type, fire-retardant paint applied at spreading rate recommended by manufacturer to achieve a total dry film thickness of not less than **4 mils**; white color for telecommunication and black for electrical.
  - 1) Moore: M59 220 Latex Fire-Retardant Coating.
  - 2) FlameControl: 20-20A Flat Latex Intumescent Coating.
- H. Fire-Rating Identification: Identify all 1- and 2-hour fire-rated partitions by stenciling rating on each side of rated walls above ceiling line with 4 inch high letters in red or orange semigloss paint; each rated wall shall be identified at least once and at a spacing not greater than 12 feet o.c.
  - 1. First Coat: Semigloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than indicated for product.
    - a. Moore: Eco Spec Interior Latex Semi-Gloss Enamel No. 224; **1.4 mils** DFT.
    - b. ICI: 1406-XXXX Dulux Professional Acrylic Semi-Gloss Interior Wall & Trim Enamel; **1.5 mils** DFT.
  - c. S-W: ProMar 200 Interior Latex Semi-Gloss B31-2200 Series; **1.5 mils** DFT.

END OF SECTION 099000

## SECTION 108500 - BUILDING 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. This Section includes the following:
  - 1. Projection screens.
  - 2. Knox box.
  - 3. Corner guards.
- B. Related Sections include the following:
  - 1. Division 06 Section "Rough Carpentry" for concealed blocking required to install building specialties.

#### 1.3 SUBMITTALS

- A. General: Submit in accordance with Division 01 Section "Submittal Procedures."
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, finishes, and method of attachment for each product indicated.
- C. Shop Drawings: Show fabrication and installation details not included in product data for each product specified. Shop Drawings shall indicate materials, gauges, dimensions and method of attachment.
- D. Maintenance Data: For all items to include in Operating and Maintenance Manuals specified in Division 01 Section "Operation and Maintenance Data."
- E. Warranties: Special warranties specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Provide corner guards with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:
  - 1. Flame-Spread Index: 25 or less.
  - 2. Smoke-Developed Index: 450 or less.

#### 1.5 WORKMANSHIP

- A. Materials, devices, equipment and apparatus of a patented or of a special nature of manufacture shall be prepared, applied, or installed in strict accordance with the manufacturer's directions.
- B. Work of this Section shall be executed in strict accordance with Drawings, approved Shop Drawings and approved samples.

- C. Insofar as possible, fitting, construction and fabrication of the work shall be executed at shops, ready for delivery and erection at buildings.
- D. Provide all holes, connections, and fastenings for and to work of other trades abutting, adjoining, or intersecting work of this Section.
- E. All items, which do not have a special finish or are not otherwise specified, shall receive one shop coat of metal primer before leaving shop.

## 1.6 WARRANTY

- A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents.
- B. Corner Guard Special Warranty: Written warranty, signed by manufacturer agreeing to replace corner guard systems that do not comply with requirements or that have material or manufacturing defects within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for manufacturer and product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  - 2. Product: Subject to compliance with requirements, provide one of the products specified.

### 2.2 PROJECTION SCREENS

- A. Classroom Projection Screens: Manufacturer's standard surface-mounted, manually operated, metal encased screen. Fabricated from formed steel sheet not less than **0.027 inch** thick or aluminum extrusions; with flat back design and vinyl covering or baked-enamel finish, color selected by Architect. Provide end caps and universal mounting brackets, finished to match end caps. Screen shall be matte-white fiberglass without black masking borders.
  - 1. Size of Viewing Surface: 7 feet high by 9 feet wide.
  - 2. Products:
    - a. Da-Lite Screen Co., Inc.; Model C.
    - b. Draper Inc.; Luma 2.

### 2.3 CORNER GUARDS

- A. Stainless Steel Corner Guards: Surface mounted, one-piece with formed edges; stainless steel, Type 304 with satin finish; not less than **0.0625 inch (1.6 mm); 3-1/2 by 3-1/2 inches (90 by 90 mm)**. Mount with flat-head, countersunk screws through factory-drilled mounting holes.

## 2.4 KNOX BOX

- A. Knox Box: Surface mount, finish to be selected by Architect. Coordinate order placement with Fire Department authorization. Coordinate mounting height and location in field with Architect.
  - 1. Quantity: One.
  - 2. Product: Knox Company; Knox Box, Series 4400.

## 2.5 FABRICATION

- A. General: Materials shall be free from defects impairing strength, durability or appearance.
- B. Sections and shapes shall be rolled, formed, drawn or extruded as required for respective functions.
- C. Molded work shall have sharply defined profile and shall be clean and straight. Plain work shall be leveled, straight and surfaces true and smooth. Edges, angles, and corners shall be square, clean and sharp, unless otherwise detailed.
- D. Fastenings, exposed metal fastenings, and accessories, unless Underwriters' prohibit for safety, shall be of same materials, texture, color and finish as the base metal to which applied.
- E. Molds, trim, frames and other metalwork shall be proper dimensions to receive masonry block and tile, plaster, ceramic tile, etc.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installers present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. All items specified under this Section shall be installed in strict accordance with manufacturer's recommendations and approved Shop Drawings.

### 3.3 CLEANING AND PROTECTION

- A. Clean building specialties in accordance with manufacturer's instructions. Touch up factory-applied finishes to restore damaged or soiled areas.
- B. Provide final protection and maintain conditions that ensure building specialties are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 108500



## SECTION 210500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

### 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 the following:
  1. Piping materials and installation instructions common to most piping systems.
  2. Sleeves.
  3. Escutcheons.
  4. Equipment installation requirements common to equipment sections.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- D. The following are industry abbreviations for rubber materials:
  1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  1. Mechanical sleeve seals.
  2. Escutcheons.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

## 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for fire-suppression installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

## 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 Division 21 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 21 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  - 1. ASME B16.21, nonmetallic, flat, asbestos-free, **1/8-inch (3.2-mm)** maximum thickness unless thickness or specific material is indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
  - 2. AWWA C110, rubber, flat face, **1/8 inch (3.2 mm)** thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.
- C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

## 2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Available Manufacturers:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 3. Pressure Plates: Carbon steel . Include two for each sealing element.
  - 4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. PVC Pipe: ASTM D 1785, Schedule 40.
- D. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated or white painted in finished spaces.
- D. One-Piece, Floor-Plate Type: Cast-iron floor plate.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 21 Sections specifying piping systems.

- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to permit valve servicing.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Select system components with pressure rating equal to or greater than system operating pressure.
- J. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - c. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with **polished chrome-plated** finish.
    - d. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
    - e. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.
- K. Sleeves are not required for core-drilled holes.
- L. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than **NPS 6 (DN 150)**.

- b. Steel Sheet Sleeves: For pipes **NPS 6 (DN 150)** and larger, penetrating gypsum-board partitions.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- N. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than **6 inches (150 mm)** in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves **6 inches (150 mm)** and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- O. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Joint Sealants" for materials.
- Q. Verify final equipment locations for roughing-in.
- R. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 21 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

### 3.3 PAINTING

A. Painting of fire-suppression systems, equipment, and components is specified in Division 09 Section "Painting."

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.4 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor fire-suppression materials and equipment.

C. Field Welding: Comply with AWS D1.1.

END OF SECTION 210500

## SECTION 211313 - 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. Fire-protection valves.
  3. Fire-department connections.
  4. Sprinklers.
  5. Alarm devices.
  6. Manual control stations.
  7. Pressure gages.

#### 1.3 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of **175 psig (1200 kPa)** maximum.

#### 1.4 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Standard-Pressure Piping System Component: Listed for **175-psig (1200-kPa)** minimum working pressure.
- B. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
  1. Retain both paragraphs below if system design has not been approved by authorities having jurisdiction.
- C. Sprinkler system design shall be approved by authorities having jurisdiction.
  1. Margin of Safety for Available Water Flow and Pressure: 10percent, including losses through water-service piping, valves, and backflow preventers.
  2. Sprinkler Occupancy Hazard Classifications:
    - a. Building Service Areas: Ordinary Hazard, Group 1
    - b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
    - c. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.

- d. Office and Public Areas: Light Hazard.
- 3. Minimum Density for Automatic-Sprinkler Piping Design:
  - a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. (4.1 mm/min. over 139-sq. m.
  - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. (6.1 mm/min. over 139-sq. m area.
- 4. Maximum Protection Area per Sprinkler:
  - a. Office Spaces: 225 sq. ft. (20.9 sq. m)
  - b. Storage Areas: 130 sq. ft. (12.1 sq. m.
  - c. Mechanical Equipment Rooms: 130 sq. ft. (12.1 sq. m.
  - d. Electrical Equipment Rooms: 130 sq. ft. (12.1 sq. m.
  - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
  - a. Light-Hazard Occupancies: 100 gpm (6.3 L/s) for 30 minutes
  - b. Ordinary-Hazard Occupancies: 250 gpm (15.75 L/s) for 60 to 90 minutes.
- D. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

## 1.6 SUBMITTALS

- A. Product Data: For each type of product indicated
- B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Wiring Diagrams: For power, signal, and control wiring.
- C. Delegated-Design Submittal: For 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.
- D. 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
  - 4. Structural framing components.
- E. Qualification Data: For qualified Installer.
- F. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- G. Fire-hydrant flow test report.



- H. 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."
- I. Field quality-control reports.
- J. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

## 1.7 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 ASME Boiler and Pressure Vessel Code.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
  - 1. NFPA 13, "Installation of Sprinkler Systems."

## 1.8 PROJECT 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 Owner no fewer than two days in advance of proposed interruption of sprinkler service.
  - 2. Do not proceed with interruption of sprinkler service without Owner's written permission.

## 1.9 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

## 1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. 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.

## PART 2 - PRODUCTS

### 2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

### 2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Pipe ends may be factory or field formed to match joining method.
- B. Thinwall Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- C. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in **NPS 5 (DN 125)** and smaller; and NFPA 13-specified wall thickness in **NPS 6 to NPS 10 (DN 150 to DN 250)**, plain end.
- D. Cast-Iron Flanges: ASME 16.1, Class 125.
- E. Grooved-Joint, Steel-Pipe Appurtenances:
  - 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. Victaulic Company.
  - 2. Pressure Rating: **175 psig (1200 kPa)** minimum.
  - 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.
  - 4. PIPING JOINING MATERIALS
- F. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic and asbestos free.
  - 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
- G. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
  - 1. LISTED FIRE-PROTECTION VALVES
- H. General Requirements:
  - 1. Valves shall be UL listed or FM approved.
  - 2. Minimum Pressure Rating for Standard-Pressure Piping: **175 psig (1200 kPa)**.
- I. Ball Valves:
  - 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:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
    - a. Victaulic Company.

3. Standard: UL 1091 except with ball instead of disc.
4. Valves **NPS 1-1/2 (DN 40)** and Smaller: Bronze body with threaded ends.
5. Valves **NPS 2 and NPS 2-1/2 (DN 50 and DN 65)**: Bronze body with threaded ends or ductile-iron body with grooved ends.
6. Valves **NPS 3 (DN 80)**: Ductile-iron body with grooved ends.
7. Valves in first paragraph below are available in NPS 2 (DN 50) and larger.
8. Valves in first paragraph below are available in NPS 2 (DN 50) and larger.

J. Check Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
  - a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
  - b. Anvil International, Inc.
  - c. Crane Co.; Crane Valve Group; Crane Valves.
  - d. Crane Co.; Crane Valve Group; Jenkins Valves.
  - e. Crane Co.; Crane Valve Group; Stockham Division.
  - f. Globe Fire Sprinkler Corporation.
  - g. Kennedy Valve; a division of McWane, Inc.
  - h. Metraflex, Inc.
  - i. Milwaukee Valve Company.
  - j. Mueller Co.; Water Products Division.
  - k. NIBCO INC.
  - l. Potter Roemer.
  - m. Reliable Automatic Sprinkler Co., Inc.
  - n. Tyco Fire & Building Products LP.
  - o. United Brass Works, Inc.
  - p. Victaulic Company.
  - q. Viking Corporation.
  - r. Watts Water Technologies, Inc.
3. Standard: UL 312.
4. Pressure Rating: **250 psig (1725 kPa)** minimum **300 psig (2070 kPa)**.
5. Type: Swing check.
6. Body Material: Cast iron.
7. End Connections: Flanged or grooved.
8. Valves in first paragraph below are available in NPS 2 (DN 50) and larger.

K. Iron OS&Y Gate Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
  - a. American Valve, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Division.
  - e. Hammond Valve.
  - f. Milwaukee Valve Company.

- g. Mueller Co.; Water Products Division.
  - h. NIBCO INC.
  - i. Tyco Fire & Building Products LP.
  - j. United Brass Works, Inc.
  - k. Watts Water Technologies, Inc.
3. Standard: UL 262.
  4. Pressure Rating: 250 psig (1725 kPa) minimum
  5. Body Material: Cast or ductile iron.
  6. End Connections: Flanged or grooved.

L. Indicating-Type Butterfly Valves:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
  - a. Anvil International, Inc.
  - b. Global Safety Products, Inc.
  - c. Kennedy Valve; a division of McWane, Inc.
  - d. Milwaukee Valve Company.
  - e. NIBCO INC.
  - f. Tyco Fire & Building Products LP.
  - g. Victaulic Company.
3. Standard: UL 1091.
4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Valves NPS 2 (DN 50) and Smaller:
  - a. Valve Type: Ball or butterfly.
  - b. Body Material: Bronze.
  - c. End Connections: Threaded.
6. Valves NPS 2-1/2 (DN 65) and Larger:
  - a. Valve Type: Butterfly.
  - b. Body Material: Cast or ductile iron.
  - c. End Connections: Flanged, grooved, or wafer.
7. Valve Operation: Integral indicating device.

### 2.3 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig (1200 kPa) minimum.

B. Angle Valves:

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. Fire Protection Products, Inc.
  - b. United Brass Works, Inc.

- C. Ball Valves:
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. Anvil International, Inc.
    - b. Conbraco Industries, Inc.; Apollo Valves.
    - c. Fire Protection Products, Inc.
    - d. Kennedy Valve; a division of McWane, Inc.
    - e. Kitz Corporation.
    - f. Milwaukee Valve Company.
    - g. NIBCO INC.
    - h. Tyco Fire & Building Products LP.
    - i. Victaulic Company.
    - j. Watts Water Technologies, Inc.

## 2.4 SPECIALTY VALVES

- A. General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Body Material: Cast or ductile iron.
  3. Size: Same as connected piping.
  4. End Connections: Flanged or grooved.
- B. Alarm Valves:
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:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
    - a. Globe Fire Sprinkler Corporation.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
  3. Standard: UL 193.
  4. Design: For horizontal or vertical installation.
  5. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages and fill-line attachment with strainer.
  6. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
  7. Drip Cup Assembly: Pipe drain with check valve to main drain piping.
- C. Automatic (Ball Drip) Drain Valves:
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:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
    - a. AFAC Inc.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
  3. Standard: UL 1726.

4. Pressure Rating: 175 psig (1200 kPa) minimum.
5. Type: Automatic draining, ball check.
6. Size: NPS 3/4 (DN 20).
7. End Connections: Threaded.

## 2.5 FIRE-DEPARTMENT CONNECTIONS

### A. Exposed-Type, Fire-Department Connection:

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product name or designation or comparable product by one of the following:
  - a. Elkhart Brass Mfg. Company, Inc.
  - b. Fire-End & Croker Corporation.
  - c. Fire Protection Products, Inc.
  - d. GMR International Equipment Corporation.
  - e. Guardian Fire Equipment, Inc.
  - f. Tyco Fire & Building Products LP.
  - g. Wilson & Cousins Inc.
3. Standard: UL 405.
4. Type: Exposed, projecting, for wall mounting.
5. Pressure Rating: 175 psig (1200 kPa) minimum.
6. Body Material: Corrosion-resistant metal.
7. Inlets: Brass with threads according to NFPA 1963 with 2-1/2" national hose threads, matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
8. Caps: Brass, lugged type, with gasket and chain.
9. Escutcheon Plate: Round, brass, wall type.
10. Outlet: Back, with pipe threads.
11. Number of Inlets: Two.
12. Escutcheon Plate Marking: Similar to AUTO SPKR."
13. Finish: Rough chrome plated or Aluminum..
14. Outlet Size: NPS 4 (DN 100).

## 2.6 SPRINKLER SPECIALTY PIPE FITTINGS

### A. Branch Outlet Fittings:

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. Anvil International, Inc.
  - b. National Fittings, Inc.
  - c. Tyco Fire & Building Products LP.
  - d. Victaulic Company.
2. Standard: UL 213.
3. Pressure Rating: 175 psig (1200 kPa) minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.

7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  8. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
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. AGF Manufacturing Inc.
    - b. Reliable Automatic Sprinkler Co., Inc.
    - c. Tyco Fire & Building Products LP.
    - d. Victaulic Company.
  2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  3. Pressure Rating: 175 psig (1200 kPa) minimum.
  4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.
  7. Fittings in first paragraph below are available in NPS 3/4 to NPS 2 (DN 20 to DN 50).
- C. Sprinkler Inspector's Test Fittings:
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. Tyco Fire & Building Products LP.
    - b. Victaulic Company.
    - c. Viking Corporation.
  2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  3. Pressure Rating: 175 psig (1200 kPa) minimum].
  4. Body Material: Cast- or ductile-iron housing with sight glass.
  5. Size: Same as connected piping.
  6. Inlet and Outlet: Threaded.
  7. Fittings in paragraph below are available in NPS sizes required for a single sprinkler.
- D. Flexible, Sprinkler Hose Fittings:
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. FlexHead Industries, Inc.
    - b. Viking.
  2. Standard: UL 1474.
  3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  4. Pressure Rating: 175 psig (1200 kPa) minimum.
  5. Size: Same as connected piping, for sprinkler.

## 2.7 SPRINKLERS

- 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. Globe Fire Sprinkler Corporation.
  2. Reliable Automatic Sprinkler Co., Inc.
  3. Tyco Fire & Building Products LP.
  4. Victaulic Company.
  5. Viking Corporation.
- B. General Requirements:
1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
  2. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
- C. Automatic Sprinklers with Heat-Responsive Element:
1. Early-Suppression, Fast-Response Applications: UL 1767.
  2. Nonresidential Applications: UL 199.
  3. Residential Applications: UL 1626.
  4. Characteristics: Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- D. Sprinkler Finishes:
1. Chrome plated.
  2. Bronze.
  3. Painted white.
  4. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
  5. Ceiling Mounting: White painted steel, two piece, with 1-inch (25-mm) vertical adjustment.
  6. Sidewall Mounting: White painted steel, two piece, with 1-inch (25-mm) adjustment.
  7. Sprinkler Guards: Chrome plated, tested in conjunction with the sprinkler type installed.
  8. 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. Reliable Automatic Sprinkler Co., Inc.
    - b. Tyco Fire & Building Products LP.
    - c. Victaulic Company.
    - d. Viking Corporation.
  9. Standard: UL 199.
  10. Type: Wire cage with fastening device for attaching to sprinkler.



## 2.8 ALARM DEVICES

- A. Alarm-device types shall match piping and equipment connections.
  - 1. Electrically Operated Alarm Bell:
  - 2. 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. Potter Electric Signal Company.
  - 3. Standard: UL 464.
  - 4. Type: Vibrating, metal alarm bell.
  - 5. Size: 6-inch (150-mm) minimum diameter.
  - 6. Finish: Red-enamel factory finish, suitable for outdoor use.
  
- B. Water-Flow Indicators:
  - 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. Potter Electric Signal Company.
  - 2. Standard: UL 346.
  - 3. Water-Flow Detector: Electrically supervised.
  - 4. 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.
  - 5. Type: Paddle operated.
  - 6. Pressure Rating: 250 psig (1725 kPa).
  - 7. Design Installation: Horizontal or vertical.
  
- C. Valve Supervisory Switches:
  - 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. Potter Electric Signal Company.
  - 2. Standard: UL 346.
  - 3. Type: Electrically supervised.
  - 4. Components: Single-pole, double-throw switch with normally closed contacts.
  - 5. Design: Signals that controlled valve is in other than fully open position.

## 2.9 PRESSURE GAGES

- 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. AMETEK; U.S. Gauge Division.
  - 2. Ashcroft, Inc.
  - 3. Brecco Corporation.
  - 4. WIKA Instrument Corporation.
  
- B. Standard: UL 393.
  
- C. Dial Size: 3-1/2- to 4-1/2-inch (90- to 115-mm) diameter.

- D. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.
- E. Water System Piping Gage: Include "WATER" label on dial face.

## 2.10 ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated or white painted finish with set-screws.

## 2.11 SLEEVES

- A. Cast-Iron Wall Pipe Sleeves: Cast or fabricated of cast iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. PVC sleeves in first two paragraphs below may be prohibited by fire authorities having jurisdiction.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
  - 1. Underdeck Clamp: Clamping ring with set-screws.

## 2.12 SLEEVE SEALS

- 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, Inc.
  - 4. Pipeline Seal and Insulator, Inc.
- B. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 1. Sealing Elements: EPDM-rubber or NBR 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: steel of length required to secure pressure plates to sealing elements.

## 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 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building.
- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

### 3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
  - 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.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- 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 (DN 50)** and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having **NPS 2-1/2 (DN 65)** 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 automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- M. 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 (DN 8)** and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.
- N. Fill sprinkler system piping with water.

### 3.4 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 (DN 50)** and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having **NPS 2-1/2 (DN 65)** 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. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
  - 1. 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.

### 3.5 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.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
  - 2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

### 3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in the center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

### 3.7 FIRE-DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type, fire-department connections.
  - 1. Install automatic (ball drip) drain valve at each check valve for fire-department connection.

### 3.8 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
  - 1. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated or white painted finish.
  - 2. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated or white painted finish.
  - 3. Bare Piping in Unfinished Service Spaces: One piece, cast brass with polished chrome-plated finish.
  - 4. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece floor plate.

### 3.9 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in floors, partitions, roofs, and walls.
- B. Sleeves are not required for core-drilled holes.
- C. Permanent sleeves are not required for holes formed by removable PE sleeves.
- D. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated.
- E. Install sleeves in new partitions, slabs, and walls as they are built.
- F. For interior wall penetrations, seal annular space between sleeve and pipe or pipe insulation using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- G. For exterior wall penetrations above grade, seal annular space between sleeve and pipe using joint sealants appropriate for size, depth, and location of joint. Comply with requirements for joint sealants in Division 07 Section "Joint Sealants."
- H. For exterior wall penetrations below grade, seal annular space between sleeve and pipe using sleeve seals.

- I. Seal space outside of sleeves in concrete slabs and walls with grout.
- J. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation unless otherwise indicated.
- K. Install sleeve materials according to the following applications:
  - 1. Sleeves for Piping Passing through Concrete Floor Slabs: Galvanized-steel pipe.
  - 2. Sleeves for Piping Passing through Concrete Floor Slabs of Mechanical Equipment Areas or Other Wet Areas: Galvanized-steel pipe.
    - a. Extend sleeves **2 inches (50 mm)** above finished floor level.
  - 3. Sleeves for Piping Passing through Gypsum-Board Partitions:
    - a. PVC-pipesleeves for pipes smaller than **NPS 6 (DN 150)**.
    - b. Galvanized-steel-sheet sleeves for pipes **NPS 6 (DN 150)** and larger.
  - 4. Sleeves for Piping Passing through Exterior Concrete Walls:
    - a. PVC-pipe or Galvanized-steel-pipe sleeves for pipes smaller than **NPS 6 (DN 150)**.
    - b. Install sleeves that are large enough to provide **1-inch (25-mm)** annular clear space between sleeve and pipe or pipe insulation when sleeve seals are used.
  - 5. Sleeves for Piping Passing through Interior Concrete Walls:
    - a. PVC-pipe or Galvanized-steel-pipe sleeves for pipes smaller than **NPS 6 (DN 150)**.
    - b. Galvanized-steel-sheet sleeves for pipes **NPS 6 (DN 150)** and larger.
- L. 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 firestop materials and installations in Division 07 Section "Penetration Firestopping."

### 3.10 SLEEVE SEAL INSTALLATION

- A. Install sleeve seals in sleeves in exterior concrete walls at water-service piping entries into building.
- B. Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble sleeve seal components and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.11 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 Division 26 Section "Identification for Electrical Systems."

### 3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 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. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

### 3.13 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

### 3.14 DEMONSTRATION

A. **Train** Owner's maintenance personnel to adjust, operate, and maintain the system

### 3.15 PIPING SCHEDULE

A. Standard-pressure, wet-pipe sprinkler system, **NPS 2 (DN 50)** and smaller, shall be one of the following:

1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight black-steel pipe with cut grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

B. Standard-pressure, wet-pipe sprinkler system, **NPS 2-1/2 to NPS 4 (DN 65 to DN 100)]** shall be one of the following:

1. Standard-weight, black-steel pipe with cut grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

C. Standard-pressure, wet-pipe sprinkler system, **NPS 5 (DN 125)** and larger, shall be one of the following:

1. Standard-weight black-steel pipe with cut grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Schedule 10 black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

### 3.16 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers
2. Rooms with Suspended Acoustical Tile Ceilings: Semi-Recessed sprinklers
3. Hard ceilings (gypsum) and soffits: Concealed plate type sprinklers.

4. Wall Mounting: Sidewall sprinklers.
  5. Spaces Subject to Freezing: Pendent, dry sprinklers.
- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
  2. Semi-Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
  3. Upright Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view. Provide protective cage in mechanical rooms.

END OF SECTION 211313



## SECTION 220500 - COMMON WORK RESULTS FOR PLUMBING

### 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 the following:
  1. Piping materials and installation instructions common to most piping systems.
  2. Transition fittings.
  3. Dielectric fittings.
  4. Mechanical sleeve seals.
  5. Sleeves.
  6. Escutcheons.
  7. Equipment installation requirements common to equipment sections.
  8. Painting and finishing.
  9. Concrete bases.
  10. Supports and anchorages.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe chases, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in chases.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- F. The following are industry abbreviations for plastic materials:
  1. ABS: Acrylonitrile-butadiene-styrene plastic.
  2. CPVC: Chlorinated polyvinyl chloride plastic.
  3. PVC: Polyvinyl chloride plastic.
- G. The following are industry abbreviations for rubber materials:
  1. EPDM: Ethylene-propylene-diene terpolymer rubber.
  2. NBR: Acrylonitrile-butadiene rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Transition fittings.
  - 2. Mechanical sleeve seals.
  - 3. Escutcheons.
- B. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Plumbing Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

#### 1.7 COORDINATION

- A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for plumbing installations.
- B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.
- C. Coordinate requirements for access panels and doors for plumbing items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 08 Section "Access Doors and Frames."

## 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 Division 22 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

### 2.3 JOINING MATERIALS

- A. Refer to individual Division 22 piping Sections for special joining materials not listed below.
- B. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- C. 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.
- D. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

### 2.4 TRANSITION FITTINGS

- A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
  - 1. Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Dresser Industries, Inc.; DMD Div.
    - c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
    - d. JCM Industries.
    - e. Smith-Blair, Inc.
    - f. Viking Johnson.
  - 2. Underground Piping **NPS 2 (DN 50)** and Larger: AWWA C219, metal sleeve-type coupling.
  - 3. Aboveground Pressure Piping: Pipe fitting.
- B. Plastic-to-Metal Transition Fittings: **[CPVC] [PVC] [CPVC and PVC]** one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. [Available] Manufacturers:
  - a. Eslon Thermoplastics.
  
- C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
  1. [Available] Manufacturers:
    - a. Thompson Plastics, Inc.
  
- D. Plastic-to-Metal Transition Unions: MSS SP-107, [CPVC] [PVC] [CPVC and PVC] four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.
  1. [Available] Manufacturers:
    - a. NIBCO INC.
    - b. NIBCO, Inc.; Chemtrol Div.
  
- E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.
  1. [Available] Manufacturers:
    - a. Cascade Waterworks Mfg. Co.
    - b. Fernco, Inc.
    - c. Mission Rubber Company.
    - d. Plastic Oddities, Inc.

## 2.5 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
  
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
  
- C. Dielectric Unions: Factory-fabricated, union assembly, for **250-psig (1725-kPa)** minimum working pressure at **180 deg F (82 deg C)**.
  1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Eclipse, Inc.
    - d. Epcos Sales, Inc.
    - e. Hart Industries, International, Inc.
    - f. Watts Industries, Inc.; Water Products Div.
    - g. Zurn Industries, Inc.; Wilkins Div.
  
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for **150- or 300-psig (1035- or 2070-kPa)** minimum working pressure as required to suit system pressures.
  1. Manufacturers:
    - a. Capitol Manufacturing Co.
    - b. Central Plastics Company.
    - c. Epcos Sales, Inc.
    - d. Watts Industries, Inc.; Water Products Div.

- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Available Manufacturers:
    - a. Calpico, Inc.
    - b. Lochinvar Corp.
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
  - 1. Available Manufacturers:
    - a. Perfection Corp.
    - b. Precision Plumbing Products, Inc.
    - c. Sioux Chief Manufacturing Co., Inc.
    - d. Victaulic Co. of America.

## 2.6 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. PVC Pipe: ASTM D 1785, Schedule 40.

## 2.7 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Stamped-Steel Type: With set screw or spring clips and chrome-plated finish.

## PART 3 - EXECUTION

### 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 22 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- F. Install piping to within 18” of the ceiling to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Insulated Piping: One-piece, stamped-steel type with spring clips.
    - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
- M. Sleeves are not required for core-drilled holes.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas **2 inches (50 mm)** above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
  - 2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
  - 3. Install sleeves that are large enough to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
    - a. Steel Pipe Sleeves: For pipes smaller than **NPS 6 (DN 150)**.
    - b. Steel Sheet Sleeves: For pipes **NPS 6 (DN 150)** and larger, penetrating gypsum-board partitions.
      - 1) Seal space outside of sleeve fittings with grout.
  - 4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than **6 inches (150 mm)** in diameter.
  2. Install cast-iron "wall pipes" for sleeves **6 inches (150 mm)** and larger in diameter.
  3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.
1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 07 Section "Joint Sealants" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 22 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. 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. PVC Nonpressure Piping: Join according to ASTM D 2855.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
  1. Install unions, in piping **NPS 2 (DN 50)** and smaller, adjacent to each valve and at final connection to each piece of equipment.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 PAINTING

- A. Painting of plumbing systems, equipment, and components is specified in Division 09 Sections "Interior Painting" and "Exterior Painting."
- B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

### 3.6 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 28-day compressive-strength concrete and reinforcement as specified in Division 03 Section "Miscellaneous Cast-in-Place Concrete."

### 3.7 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 05 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor plumbing materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

END OF SECTION 220500



## SECTION 220519 - 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. Gages.
  - 2. Test plugs.
- B. Related Sections:
  - 1. Division 22 Section "Domestic Water Piping" for domestic and fire-protection water service meters inside the building.
  - 2. Division 22 Section "Facility Natural-Gas Piping" for gas meters.

#### 1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. EPDM: Ethylene-propylene-diene terpolymer rubber.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated; include performance curves.

### PART 2 - PRODUCTS

#### 2.1 PRESSURE GAGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Terice H.O. Co. product indicated on Drawings or comparable product by one of the following:
  - 1. AMETEK, Inc.; U.S. Gauge Div.
  - 2. Ashcroft Commercial Instrument Operations; Dresser Industries; Instrument Div.
  - 3. Palmer - Wahl Instruments Inc.
  - 4. Terice, H. O. Co.
  - 5. Weiss Instruments, Inc.
  - 6. Weksler Instruments Operating Unit; Dresser Industries; Instrument Div.
- C. Direct-Mounting, Dial-Type Pressure Gages: Indicating-dial type complying with ASME B40.100.
  - 1. Case: Dry type, drawn steel or cast aluminum , 4-1/2-inch (114-mm) diameter.
  - 2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.

3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic .
8. Ring: Metal, Brass or Stainless steel].
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
11. Range for Fluids under Pressure: Two times operating pressure.

D. Remote-Mounting, Dial-Type Pressure Gages: ASME B40.100, indicating-dial type.

1. Case: Dry type, drawn steel or cast aluminum, 4-1/2-inch (114-mm) diameter with holes for panel mounting.
2. Pressure-Element Assembly: Bourdon tube, unless otherwise indicated.
3. Pressure Connection: Brass, NPS 1/4 (DN 8), bottom-outlet type unless back-outlet type is indicated.
4. Movement: Mechanical, with link to pressure element and connection to pointer.
5. Dial: Satin-faced, nonreflective aluminum with permanently etched scale markings.
6. Pointer: Red or other dark-color metal.
7. Window: Glass or plastic .
8. Ring: Metal, Brass or Stainless steel].
9. Accuracy: Grade A, plus or minus 1 percent of middle half scale.
10. Vacuum-Pressure Range: 30-in. Hg of vacuum to 15 psig of pressure (100 kPa of vacuum to 103 kPa of pressure).
11. Range for Fluids under Pressure: Two times operating pressure.

E. Pressure-Gage Fittings:

1. Valves: NPS 1/4 (DN 8) brass or stainless-steel needle type.
2. Snubbers: ASME B40.5, NPS 1/4 (DN 8) brass bushing with corrosion-resistant, porous-metal disc of material suitable for system fluid and working pressure.

## 2.2 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Trerice H.O. Co. or comparable product by one of the following:
  1. Flow Design, Inc.
  2. MG Piping Products Co.
  3. National Meter, Inc.
  4. Peterson Equipment Co., Inc.
  5. Sisco Manufacturing Co.
  6. Trerice, H. O. Co.
  7. Watts Industries, Inc.; Water Products Div.
- C. Description: Corrosion-resistant brass or stainless-steel body with core inserts and gasketed and threaded cap, with extended stem for units to be installed in insulated piping.

- D. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F (3450 kPa at 93 deg C).
- E. Core Inserts: One or two self-sealing rubber valves.
  - 1. Insert material for water service at 20 to 200 deg F (minus 7 to plus 93 deg C) shall be CR.
  - 2. Insert material for water service at minus 30 to plus 275 deg F (minus 35 to plus 136 deg C) shall be EPDM.

### PART 3 - EXECUTION

#### 3.1 GAGE APPLICATIONS

- A. Install dry-case-type pressure gages for discharge of each pressure-reducing valve.
- B. Install dry-case-type pressure gages at suction and discharge of each pump.
- C. Pressure scale: 0 to 100 psi at 2 psi scale divisions.

#### 3.2 INSTALLATIONS

- A. Install direct-mounting pressure gages in piping tees with pressure gage located on pipe at most readable position.
- B. Install remote-mounting pressure gages on panel.
- C. Install needle-valve and snubber fitting in piping for each pressure gage.
- D. Install test plugs in tees in piping.
- E. Install permanent indicators on walls or brackets in accessible and readable positions.
- F. Install connection fittings for attachment to portable indicators in accessible locations.
- G. Install gages adjacent to machines and equipment to allow service and maintenance for thermometers, gages, machines, and equipment.
- H. Adjust faces of gages to proper angle for best visibility from the floor.

END OF SECTION 220519

## SECTION 220523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Bronze ball valves.
  - 2. Bronze swing check valves.
- B. Related Sections:
  - 1. Division 22 Section "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

#### 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 SUBMITTALS

- A. Product Data: For each type of valve indicated.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
  - 1. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
  - 2. ASME B31.1 for power piping valves.
  - 3. ASME B31.9 for building services piping valves.
- C. NSF Compliance: NSF 61 for valve materials for potable-water service.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
  - 1. Protect internal parts against rust and corrosion.
  - 2. Protect threads, flange faces, grooves, and weld ends.
  - 3. Set ball and plug 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.

## 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. Valves in Insulated Piping: With **2-inch (50-mm)** 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.
- E. Valve-End Connections:
  - 1. Solder Joint: With sockets according to ASME B16.18.
  - 2. Threaded: With threads according to ASME B1.20.1.
- F. Valve Bypass and Drain Connections: MSS SP-45.

### 2.2 BRONZE BALL VALVES

- A. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim:
  - 1. Manufacturers: Subject to compliance with requirements :
    - a. Conbraco Industries, Inc.; Apollo Valves.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-110.
    - b. SWP Rating: **150 psig (1035 kPa)**.
    - c. CWP Rating: **600 psig (4140 kPa)**.
    - d. Body Design: Two piece.
    - e. Body Material: Bronze.
    - f. Ends: Threaded or Sweat.
    - g. Seats: PTFE or TFE.

- h. Stem: Bronze.
- i. Ball: Chrome-plated brass.
- j. Port: Full.

## 2.3 BRONZE SWING CHECK VALVES

- A. Class 125, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, :
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 200 psig (1380 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.
  
- B. Class 150, Bronze Swing Check Valves with Bronze Disc:
  - 1. Manufacturers: Subject to compliance with requirements, :
    - a. American Valve, Inc.
    - b. Crane Co.; Crane Valve Group; Crane Valves.
    - c. Crane Co.; Crane Valve Group; Jenkins Valves.
    - d. Crane Co.; Crane Valve Group; Stockham Division.
    - e. Milwaukee Valve Company.
    - f. NIBCO INC.
    - g. Zy-Tech Global Industries, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 3.
    - b. CWP Rating: 300 psig (2070 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: Bronze.
  
- C. Class 150, Bronze Swing Check Valves with Nonmetallic Disc:
  - 1. Manufacturers: Subject to compliance with requirements, :
    - a. Hammond Valve.
    - b. Milwaukee Valve Company.
    - c. NIBCO INC.
    - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
  - 2. Description:
    - a. Standard: MSS SP-80, Type 4.
    - b. CWP Rating: 300 psig (2070 kPa).
    - c. Body Design: Horizontal flow.
    - d. Body Material: ASTM B 62, bronze.
    - e. Ends: Threaded.
    - f. Disc: PTFE or TFE.

## 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, valves.
  - 2. Throttling Service: Ball valves.
- 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 (DN 50)** and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

### 3.5 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

#### A. Pipe **NPS 2 (DN 50)** and Smaller:

1. Ball Valves: Two piece, full port, bronze with bronze trim.
2. Bronze Swing Check Valves: Class 150, bronze disc.

END OF SECTION 220523



## SECTION 220529 - 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. This Section includes the following hangers and supports for plumbing system piping and equipment:
  - 1. Steel pipe hangers and supports.
- B. Trapeze pipe hangers.
- C. Related Sections include the following:
  - 1. Division 21 Section "Wet – Pipe Sprinkler Systems" for pipe hangers for fire-suppression piping.

#### 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 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and 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. Manufacturers: Subject to compliance with requirements, provide products by one of the 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. ERICO/Michigan Hanger Co.
  - 4. Grinnell Corp.
- C. 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 METAL FRAMING SYSTEMS

- A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.
- B. Available Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. Power-Strut Div.; Tyco International, Ltd.
  - 3. Unistrut Corp.; Tyco International, Ltd.
- C. Coatings: Manufacturer's standard finish unless bare metal surfaces are indicated.

### 2.5 PIPE POSITIONING SYSTEMS

- A. Description: IAPMO PS 42, system of metal brackets, clips, and straps for positioning piping in pipe spaces for plumbing fixtures for commercial applications.
- B. Available Manufacturers:
  - 1. C & S Mfg. Corp.
  - 2. HOLDRITE Corp.; Hubbard Enterprises.
  - 3. Samco Stamping, Inc.

## 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. Use padded hangers for piping that is subject to scratching.
- F. 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 (DN 15 to DN 750)**.
  2. Pipe Hangers (MSS Type 5): For suspension of pipes, **NPS 1/2 to NPS 4 (DN 15 to DN 100)**, to allow off-center closure for hanger installation before pipe erection.
- G. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, **NPS 1/2 to NPS 8 (DN 15 to DN 200)**.
- H. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, **NPS 3/4 to NPS 20 (DN 20 to DN 500)**, if longer ends are required for riser clamps.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  2. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  3. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
  4. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
- K. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- L. Fixtures to support supply and waste piping for plumbing fixtures.

### 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. 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 above for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- 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. Pipe Positioning System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture. Refer to Division 22 Section "Plumbing Fixtures" for plumbing fixtures.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9 (for building services piping) are not exceeded.
- H. 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. Do not exceed pipe stress limits according to ASME B31.9 for building services piping.
  2. 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 (DN 100)** and larger if pipe is installed on rollers.
  3. Shield Dimensions for Pipe: Not less than the following:
    - a. **NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm)** long and **0.048 inch (1.22 mm)** thick.
  4. Insert Material: Length at least as long as protective shield.
  5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers.

### 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**.

END OF SECTION 220529

## SECTION 220553 - 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. Warning signs and labels.
  - 2. Pipe labels.

#### 1.3 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.

#### 1.4 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 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, **[1/16 inch (1.6 mm)] PIPE LABELS**
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.
- C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

- D. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- E. 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 (38 mm)** high.

## 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.
- 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 **50 feet (15 m)** along each run. Reduce intervals to **25 feet (7.6 m)** in areas of congested piping and equipment.
- B. Pipe Label Color Schedule:
  - 1. Domestic Cold Water Piping:
    - a. Background Color: Green .
    - b. Letter Color: White
  - 2. Domestic Hot Water Piping:
    - a. Background Color: Yellow.
    - b. Letter Color: Black.

### 3.4 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

## SECTION 220700 - PLUMBING INSULATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Insulation Materials:
    - a. Flexible elastomeric.
    - b. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Lagging adhesives.
  - 6. Sealants.
  - 7. Factory-applied jackets.
  - 8. Field-applied fabric-reinforcing mesh.
  - 9. Field-applied cloths.
  - 10. Field-applied jackets.
  - 11. Tapes.
  - 12. Securements.
  - 13. Corner angles.
- B. Related Sections include the following:
  - 1. Division 23 Section "HVAC Insulation."

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, thickness, and jackets (both factory and field applied, if any).
- B. Shop Drawings:
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.
  - 8. Detail field application for each equipment type.
- 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. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation 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.

#### 1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application and equipment Installer for equipment insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

#### 1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.



## PART 2 - PRODUCTS

### 2.1 INSULATION MATERIALS

- A. Comply with requirements in Part 3 schedule articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA Inc.; Aerocel EPDM - sheet and tube.
    - b. Armacell LLC; AP Armaflex - sheet and tube.
    - c. K-Flex USA; Insul-Sheet and Insul-Tube.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Johns Manville; Micro-Lok.
    - b. Knauf Insulation; Pipe Insulation with ECOSE Technology.
    - c. Owens Corning; Fiberglas Pipe Insulation.
  - 2. Type I, 850 deg F (454 deg C) Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

### 2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; Triple I.
    - b. P. K. Insulation Mfg. Co., Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Insulco, Division of MFS, Inc.; SmoothKote.
    - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
    - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Aeroflex USA Inc.; Aeroseal.
    - b. Armacell LCC; 520 Adhesive.
    - c. Foster Products Corporation, H. B. Fuller Company; 85-75.
    - d. RBX Corporation; Rubatex Contact Adhesive.
  - 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).
- C. 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 Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. 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).
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. 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).
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Dow Chemical Company (The); 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; Speedline Vinyl Adhesive.
  - 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).

## 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 Products, Division of ITW; CP-76.

## 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. PVDC Jacket for Indoor Applications: **4-mil- (0.10-mm-)** thick, white PVDC biaxially oriented barrier film with a permeance at **0.02 perms (0.013 metric perms)** when tested according to ASTM E 96 and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
    - a. Products: Subject to compliance with requirements, provide the following :
      - 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

## 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. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0835.
    - b. Compac Corp.; 104 and 105.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 428 AWF ASJ.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: **3 inches (75 mm)**.
  3. Thickness: **11.5 mils (0.29 mm)**.
  4. Adhesion: **90 ounces force/inch (1.0 N/mm)** in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: **40 lbf/inch (7.2 N/mm)** 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 one of the following:
    - a. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0555.
    - b. Compac Corp.; 130.
    - c. Ideal Tape Co., Inc., an American Biltrite Company; 370 White PVC tape.
    - d. Venture Tape; 1506 CW NS.
  2. Width: **2 inches (50 mm)**.
  3. Thickness: **6 mils (0.15 mm)**.
  4. Adhesion: **64 ounces force/inch (0.7 N/mm)** in width.
  5. Elongation: 500 percent.
  6. Tensile Strength: **18 lbf/inch (3.3 N/mm)** in width.

## 2.7 CORNER ANGLES

- A. PVC Corner Angles: 30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.
  - 1. Verify that systems and equipment to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
  - 3. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. 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 equipment and piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment and pipe system as specified in insulation system schedules.
- 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- (75-mm-)** wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced **4 inches (100 mm)** o.c.
  - 3. Overlap jacket longitudinal seams at least **1-1/2 inches (38 mm)**. 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 (50 mm)** o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  - 4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- 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 (100 mm)** 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 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 (50 mm)** 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 (50 mm)**.
  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 Division 07 Section "Joint Sealants" 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 Division 07 Section "Joint Sealants".

### 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, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- 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 FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- B. Insulation Installation on Pipe Flanges:
  1. Install pipe insulation to outer diameter of pipe flange.
  2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
  1. Install mitered sections of pipe insulation.
  2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
  1. Install preformed valve covers manufactured of same material as pipe insulation when available.
  2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  3. Install insulation to flanges as specified for flange insulation application.
  4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 MINERAL-FIBER INSULATION INSTALLATION

- A. Insulation Installation on Straight Pipes and Tubes:
  1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above ambient surfaces, secure laps with outward clinched staples at **6 inches (150 mm)** o.c.
  4. For insulation with factory-applied jackets on below ambient surfaces, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.



- B. Insulation Installation on Pipe Fittings and Elbows:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.
- C. Insulation Installation on Valves and Pipe Specialties:
  - 1. Install preformed sections of same material as straight segments of pipe insulation when available.
  - 2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
  - 3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
  - 4. Install insulation to flanges as specified for flange insulation application.

### 3.8 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 (50-mm)** overlap at seams and joints.
  - 2. Embed glass cloth between two **0.062-inch- (1.6-mm-)** thick coats of lagging adhesive.
  - 3. Completely encapsulate insulation with coating, leaving no exposed insulation.
- B. Where PVC jackets are indicated, install with **1-inch (25-mm)** overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  - 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with **2-inch (50-mm)** overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands **12 inches (300 mm)** o.c. and at end joints.

### 3.9 FINISHES

- A. Equipment and Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect field-insulated equipment, 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 one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
  - 2. 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. Insulation applications will be considered Defective Work if sample inspection reveals noncompliance with requirements.

### 3.11 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. Insulation specified for piping shall apply to flexible tubing as well as rigid piping.
- C. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Underground piping.

### 3.12 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
  - 1. NPS 1/2 and NPS 3/4 : Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
  - 2. NPS 1 (DN 25) and NPS 1-1/4 (DN 32): Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch (13 mm) thick.
  - 3. NPS 1-1/2 (DN 40) and Larger: Insulation shall be one of the following:
    - a. Flexible Elastomeric: 1/2 inch (13 mm) thick.
    - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
- B. Domestic Hot Water:
  - 1. NPS 1 (DN 25) and Smaller: Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.
  - 2. NPS 1-1/4 (DN 32) : Insulation shall be the following:
    - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.

3. NPS 1-1/2 (DN 40) and NPS 2 (DN 50) : Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch (38 mm) thick.
4. NPS 2-1/2 (DN 63): Insulation shall be the following:
  - a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inch (50 mm) thick.

END OF SECTION 220700

## SECTION 221116 - DOMESTIC WATER PIPING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Under-building slab and aboveground domestic water pipes, tubes, fittings, and specialties inside the building.
  - 2. Escutcheons.
  - 3. Sleeves and sleeve seals.
  - 4. Water penetration systems.

#### 1.3 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 61 for potable domestic water piping and components.

#### 1.4 PROJECT 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 Owner no fewer than two days in advance of proposed interruption of water service.
  - 2. Do not proceed with interruption of water service 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.

#### 2.2 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: **ASTM B 88, Type L (ASTM B 88M, Type B)** water tube, drawn temper.
  - 1. Cast-Copper Solder-Joint Fittings: ASME B16.18, pressure fittings.
  - 2. Wrought-Copper Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
  - 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Elkhart Products Corporation; Industrial Division.
  - 2) NIBCO INC.
- b. **NPS 2 (DN 50)** and Smaller: Wrought-copper fitting with EPDM-rubber O-ring seal in each end.

## 2.3 PIPING JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

## 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.

## 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 shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance.
- C. Install domestic water piping level and plumb.
- D. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- G. Install piping adjacent to equipment and specialties to allow service and maintenance.
- H. Install piping to permit valve servicing.
- I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than system pressure rating used in applications below unless otherwise indicated.

- J. Install piping free of sags and bends.
- K. Install fittings for changes in direction and branch connections.

### 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. Soldered Joints: 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."
- D. Copper-Tubing, Push-on Joints: Clean end of tube. Measure insertion depth with manufacturer's depth gage. Join copper tube and push-on-joint fittings by inserting tube to measured depth.

### 3.3 VALVE INSTALLATION

- A. General-Duty Valves: Comply with requirements in Division 22 Section "General-Duty Valves for Plumbing Piping" for valve installations.
- B. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball valves for piping **NPS 2 (DN 50)** and smaller.
- C. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping. Drain valves are specified in Division 22 Section "Domestic Water Piping Specialties."
  - 1. Hose-End Drain Valves: At low points in water mains, risers, and branches.
  - 2. Stop-and-Waste Drain Valves: Instead of hose-end drain valves where indicated.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support products and installation.

### 3.5 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment and machines to allow service and maintenance.
- C. Connect domestic water piping to existing water piping within the building.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Comply with requirements in Division 22 plumbing fixture Sections for connection sizes.

### 3.6 ESCUTCHEON INSTALLATION

- A. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. Escutcheons for New Piping:
  - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
  - 2. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish .
  - 3. Bare Piping at Ceiling Penetrations in Finished Spaces: One piece, cast brass with polished chrome-plated finish .
- C. Escutcheons for Existing Piping:
  - 1. Chrome-Plated Piping: Split casting, cast brass with chrome-plated finish.
  - 2. Insulated Piping: Split plate, stamped steel with concealed hinge and spring clips.

### 3.7 IDENTIFICATION

- A. Identify system components. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for identification materials and installation.
- B. Label pressure piping with system operating pressure.

### 3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Piping Inspections:
  - 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
  - 2. 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:
    - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
    - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
  - 3. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
  - 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- C. Piping Tests:
  - 1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
  - 2. 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.
  - 3. 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.

4. Cap and subject piping to static water pressure of 50 psig (345 kPa) above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
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 for corrective action required.

D. Domestic water piping will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

### 3.9 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
  
4. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
7. 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 (50 mg/L) 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 (200 mg/L) 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. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

B. Prepare and submit reports of purging and disinfecting activities.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.



### 3.11 PIPING SCHEDULE

- A. Aboveground domestic water piping, **NPS 2 (DN 50)** and smaller, shall be one of the following:
  - 1. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B)**; cast-copper solder-joint fittings; and soldered joints.
  - 2. Hard copper tube, **ASTM B 88, Type L (ASTM B 88M, Type B)** ; copper push-on-joint fittings; and push-on 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 (DN 50)** and smaller. Use butterfly, ball, or gate valves with flanged ends for piping **NPS 2-1/2 (DN 65)** and larger.
  - 2. Drain Duty: Hose-end drain valves.
- B. Use check valves to maintain correct direction of domestic water flow to and from equipment.
- C. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221116

## SECTION 221119 - 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. This Section includes the following domestic water piping specialties:
  - 1. Backflow preventers.
  - 2. Outlet boxes.
  - 3. Drain valves.
  - 4. Water hammer arresters.
- B. Related Sections include the following:
  - 1. Division 22 Section "Meters and Gages for Plumbing Piping" for thermometers, pressure gages, and flow meters in domestic water piping.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: **125 psig (860 kPa)**, unless otherwise indicated.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and Maintenance Data: For domestic water piping specialties 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. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.
  - 2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

## PART 2 - PRODUCTS

### 2.1 BACKFLOW PREVENTERS

#### A. Reduced-Pressure-Principle Backflow Preventers:

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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
3. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
  - a. Ames Co.
  - b. FEBCO; SPX Valves & Controls.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Wilkins Div.
4. Standard: ASSE 1013.
5. Operation: Continuous-pressure applications.
6. Water Entrance Size: 1" **NPS (DN)**.
7. Design Flow Rate: 75 **gpm (L/s)**.
8. Pressure Loss at Design Flow Rate: 10 **psig (kPa)** for sizes **NPS 2 (DN 50)** and smaller
9. Body: Bronze for **NPS 2 (DN 50)** and smaller.
10. End Connections: Threaded for **NPS 2 (DN 50)** and smaller.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of **NPS 2 (DN 50)**.
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

### 2.2 OUTLET BOXES

#### A. Clothes Washer Outlet Boxes:

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:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Oatey.
  - b. Symmons Industries, Inc.
  - c. Watts Industries, Inc.; Water Products Div.
  - d. Zurn Plumbing Products Group; Light Commercial Operation.
3. Mounting: Recessed.
4. Material and Finish: Plastic box and faceplate.
5. Faucet: Combination, valved fitting or separate hot- and cold-water, valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
6. Supply Shutoff Fittings: **NPS 1/2 (DN 15)** independent ball valves with integral hammer arrestors on each valve and **NPS 1/2 (DN 15)** copper, water tubing.
7. Drain: **NPS 2 (DN 50)** standpipe and P-trap for direct waste connection to drainage piping.
8. Inlet Hoses: Two **60-inch- (1500-mm-)** long, rubber household clothes washer inlet hoses with female, garden-hose-thread couplings. Include rubber washers.

9. Drain Hose: One 48-inch- (1200-mm-) long, rubber household clothes washer drain hose with hooked end.

## 2.3 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 (2760-kPa) minimum CWP.
  3. Size: NPS 3/4 (DN 20).
  4. Body: Copper alloy.
  5. Ball: Chrome-plated brass.
  6. Seats and Seals: Replaceable.
  7. Handle: Vinyl-covered steel.
  8. Inlet: Threaded or solder joint.
  9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.
  
- B. Stop-and-Waste Drain Valves:
  1. Standard: MSS SP-110 for ball.
  2. Pressure Rating: 200-psig (1380-kPa) minimum CWP or Class 125.
  3. Size: NPS 3/4 (DN 20).
  4. Body: Copper alloy or ASTM B 62 bronze.
  5. Drain: NPS 1/8 (DN 6) side outlet with cap.

## 2.4 WATER HAMMER ARRESTERS

- A. Water Hammer Arresters:
  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:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. PPP Inc.
    - b. Sioux Chief Manufacturing Company, Inc.
    - c. Watts Drainage Products Inc.
    - d. Zurn Plumbing Products Group; Specification Drainage Operation.
  3. Standard: ASSE 1010 or PDI-WH 201.
  4. Type: Copper tube with piston.
  5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
  
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- C. Install outlet boxes recessed in wall. Install **2-by-4-inch (38-by-89-mm)** fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 06 Section "Rough Carpentry."
- D. Install water hammer arresters in water piping according to PDI-WH 201.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

END OF SECTION 221119

## SECTION 221316 - 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. This Section includes the following for soil gas vent piping within the building.
  1. Pipe, tube, and fittings.
  2. Special pipe fittings.

#### 1.3 DEFINITIONS

- A. BS: Acrylonitrile-butadiene-styrene plastic.
- B. PVC: Polyvinyl chloride plastic.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
- B. Soil, Waste, and Vent Piping: 10-foot head of water (30 kPa or 5psi).

#### 1.5 SUBMITTALS

- A. Product Data: For pipe, tube, fittings, and couplings.
- B. Field quality-control inspection and test reports.

#### 1.6 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; "NSF-drain" for plastic drain piping; "NSF-tubular" for plastic continuous waste piping; and "NSF-sewer" for plastic sewer piping.

### 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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

## 2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

## 2.3 PVC PIPE AND FITTINGS

- A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.
  1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.
- B. Solvent Cement and Adhesive Primer:
  1. Use PVC solvent cement that has a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  2. Use adhesive primer that has a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

## PART 3 - EXECUTION

### 3.1 EXCAVATION

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING APPLICATIONS

- A. Aboveground, soil and waste piping shall be the following:
  1. PVC pipe, PVC socket fittings, and solvent-cemented joints.
- B. Aboveground, vent piping shall be the following:
  1. PVC pipe, PVC socket fittings, and solvent-cemented joints.
  - 2.

### 3.3 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. Install cleanouts per code and extend to existing sanitary drains as indicated on Contract Drawings.
- C. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.
- D. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used

on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- E. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow for piping NPS 3 (DN 80) and smaller; 1 percent downward in direction of flow for piping NPS 4 (DN 100) and larger.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- F. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.
- G. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.4 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Common Work Results for Plumbing."
- B. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.5 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Install individual, straight, horizontal piping runs according to the following:
- B. Install supports according to Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- E. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2 (DN 40 and DN 50): 48 inches (1200 mm) with 3/8-inch (10-mm) rod.
  - 2. NPS 3 (DN 80): 48 inches (1200 mm) with 1/2-inch (13-mm) rod.
  - 3. NPS 4 and 5 (DN 100 and 125): 48 inches (1200 mm) with 5/8-inch (16-mm) rod.
  - 4. NPS 6 (DN 150): 48 inches (1200 mm) with 3/4-inch (19-mm) rod.
- F. Install supports for vertical PVC piping every 48 inches (1200 mm).



- G. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect drainage and vent piping to the following:
  1. Plumbing Fixtures: Connect drainage 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 drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.

### 3.7 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 drainage 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. 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 drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
  3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than **10-foot head of water (30 kPa)**. From 15 minutes before inspection starts to completion of inspection, water level must not drop. 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. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of **1-inch wg (250 Pa)**. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

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.

### 3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains 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.

END OF SECTION 221316

## SECTION 221613 - FACILITY NATURAL-GAS 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. Pipes, tubes, and fittings.
  2. Piping specialties.
  3. Piping and tubing joining materials.
  4. Valves.
  5. Mechanical sleeve seals.

#### 1.3 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
  1. Piping and Valves: 40 psig minimum unless otherwise indicated.
- B. Natural-Gas System Pressure within Buildings: 0.5 psig (3.45 kPa) or less.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

#### 1.5 SUBMITTALS

- A. Product Data: For each type of the following:
  1. Piping specialties.
  2. Corrugated, stainless-steel tubing with associated components.
  3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
  4. Dielectric fittings.

- 5. Mechanical sleeve seals.
- 6. Escutcheons.

- B. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- C. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- D. Qualification Data: For qualified professional engineer.
- E. Welding certificates.
- F. Field quality-control reports.

#### 1.6 QUALITY ASSURANCE

- A. Steel Support 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.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. 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.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.
- D. Protect stored PE pipes and valves from direct sunlight.

#### 1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

#### 1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

## PART 2 - PRODUCTS

### 2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
  - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
  - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
  - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
    - a. Material Group: 1.1.
    - b. End Connections: Threaded or butt welding to match pipe.
    - c. Lapped Face: Not permitted underground.
    - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
    - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
  - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
    - a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
  - 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. OmegaFlex, Inc.
    - b. Parker Hannifin Corporation; Parflex Division.
    - c. Titeflex.
    - d. Tru-Flex Metal Hose Corp.
  - 2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
  - 3. Coating: PE with flame retardant.
    - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      - 1) Flame-Spread Index: 25 or less.
      - 2) Smoke-Developed Index: 50 or less.
  - 4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
  - 5. Striker Plates: Steel, designed to protect tubing from penetrations.
  - 6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.

7. Operating-Pressure Rating: 5 psig (34.5 kPa).
  8. Underground Piping: Provide manufacturer's vented sleeve and fittings.
- C. PE Pipe: ASTM D 2513, SDR 11.
1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
  2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
  3. Anodeless Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    - b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    - c. Aboveground Portion: PE transition fitting.
    - d. Outlet shall be threaded or flanged or suitable for welded connection.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  4. Transition Service-Line Risers: Factory fabricated and leak tested.
    - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    - b. Outlet shall be threaded or flanged or suitable for welded connection.
    - c. Bridging sleeve over mechanical coupling.
    - d. Factory-connected anode.
    - e. Tracer wire connection.
    - f. Ultraviolet shield.
    - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
  5. Plastic Mechanical Couplings, NPS 1-1/2 (DN 40) and Smaller: Capable of joining PE pipe to PE pipe.
    - a. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
      - 1) Lyall, R. W. & Company, Inc.
      - 2) Mueller Co.; Gas Products Div.
      - 3) Perfection Corporation; a subsidiary of American Meter Company.
    - b. PE body with molded-in, stainless-steel support ring.
    - c. Buna-nitrile seals.
    - d. Acetal collets.
    - e. Electro-zinc-plated steel stiffener.
  6. Plastic Mechanical Couplings, NPS 2 (DN 50) and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Lyall, R. W. & Company, Inc.
      - 2) Mueller Co.; Gas Products Div.
      - 3) Perfection Corporation; a subsidiary of American Meter Company.
    - b. Fiber-reinforced plastic body.
    - c. PE body tube.
    - d. Buna-nitrile seals.

- e. Acetal collets.
- f. Stainless-steel bolts, nuts, and washers.
- 7. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Dresser Piping Specialties; Division of Dresser, Inc.
    - 2) Smith-Blair, Inc.
  - b. Steel flanges and tube with epoxy finish.
  - c. Buna-nitrile seals.
  - d. Steel bolts, washers, and nuts.
  - e. Factory-installed anode for steel-body couplings installed underground.

## 2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
  - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
  - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
  - 3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
  - 4. Corrugated stainless-steel tubing with polymer coating.
  - 5. Operating-Pressure Rating: **0.5 psig (3.45 kPa)**.
  - 6. End Fittings: Zinc-coated steel.
  - 7. Threaded Ends: Comply with ASME B1.20.1.
  - 8. Maximum Length: **72 inches (1830 mm)**.
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
  - 1. Copper-alloy convenience outlet and matching plug connector.
  - 2. Nitrile seals.
  - 3. Hand operated with automatic shutoff when disconnected.
  - 4. For indoor or outdoor applications.
  - 5. Adjustable, retractable restraining cable.
- C. 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 (DN 50)** and smaller; flanged ends for **NPS 2-1/2 (DN 65)** and larger.
  - 3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: **125 psig (862 kPa)**.
- D. Basket Strainers:
  - 1. Body: ASTM A 126, Class B, high-tensile cast iron with bolted cover and bottom drain connection.
  - 2. End Connections: Threaded ends for **NPS 2 (DN 50)** and smaller; flanged ends for **NPS 2-1/2 (DN 65)** and larger.
  - 3. Strainer Screen: 40] -mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
  - 4. CWP Rating: **125 psig (862 kPa)**.
- E. T-Pattern Strainers:

1. Body: Ductile or malleable iron with removable access coupling and end cap for strainer maintenance.
  2. End Connections: Grooved ends.
  3. Strainer Screen: 40] -mesh startup strainer, and perforated stainless-steel basket with 57 percent free area.
  4. CWP Rating: 750 psig (5170 kPa).
- F. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

## 2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. 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.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F (540 deg C) complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

## 2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 (DN 50) and Smaller: Comply with ASME B16.33.
  1. CWP Rating: 125 psig (862 kPa).
  2. Threaded Ends: Comply with ASME B1.20.1.
  3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
  4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch (25 mm) and smaller.
  6. Service Mark: Valves 1-1/4 inches (32 mm) to NPS 2 (DN 50) shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 (DN 65) and Larger: Comply with ASME B16.38.
  1. CWP Rating: 125 psig (862 kPa).
  2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
  3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
  4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.



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. Watts
  - b. Nibco
  - c. Conbraco Industries, Inc.; Apollo Div.
2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig (4140 kPa).
9. Listing: Valves NPS 1 (DN 25) and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

## 2.5 MOTORIZED GAS VALVES

- A. Electrically Operated Valves: Comply with UL 429.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  2. Basis-of-Design Product: Subject to compliance with requirements, provide ASCO or comparable product by one of the following:
    - a. ASCO Power Technologies, LP; Division of Emerson.
    - b. Magnatrol Valve Corporation.
    - c. Watts  
Watts Regulator Co.; Division of Watts Water Technologies, Inc.
  3. Model: Series 8214C-CSA.
  4. Pilot operated.
  5. Body: Brass or aluminum.
  6. Seats and Disc: Nitrile rubber.
  7. Springs and Valve Trim: Stainless steel.
  8. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
  9. NEMA ICS 6, Type 4, coil enclosure.
  10. Normally closed.
  11. Visual position indicator.

## 2.6 EARTHQUAKE VALVES

- A. Earthquake Valves: Comply with ASCE 25.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Vanguard Valves, Inc.
  2. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction.
  3. Maximum Operating Pressure: 5 psig (34.5 kPa).
  4. Cast-aluminum body with nickel-plated chrome steel internal parts.
  5. Nitrile-rubber valve washer.
  6. Sight windows for visual indication of valve position.
  7. Threaded end connections complying with ASME B1.20.1.

8. Wall mounting bracket with bubble level indicator.

## 2.7 PRESSURE REGULATORS

### A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators **NPS 2 (DN 50)** and smaller; flanged for regulators **NPS 2-1/2 (DN 65)** and larger.

### B. Appliance Pressure Regulators: Comply with ANSI Z21.18.

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:
2. Basis-of-Design Product: Subject to compliance with requirements, provide product or comparable product by one of the following:
  - a. Canadian Meter Company Inc.
  - b. Eaton Corporation; Controls Div.
  - c. Harper Wyman Co.
  - d. Maxitrol Company.
  - e. SCP, Inc.
3. Body and Diaphragm Case: Die-cast aluminum.
4. Springs: Zinc-plated steel; interchangeable.
5. Diaphragm Plate: Zinc-plated steel.
6. Seat Disc: Nitrile rubber.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
9. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
10. Maximum Inlet Pressure: **1 psig (6.9 kPa)**.

## 2.8 DIELECTRIC FITTINGS

### A. Dielectric Unions:

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. Capitol Manufacturing Company.
  - b. Central Plastics Company.
  - c. Hart Industries International, Inc.
  - d. McDonald, A. Y. Mfg. Co.
  - e. Watts Regulator Co.; Division of Watts Water Technologies, Inc.
  - f. Wilkins; Zurn Plumbing Products Group.
2. Minimum Operating-Pressure Rating: **150 psig (1034 kPa)**.
3. Combination fitting of copper alloy and ferrous materials.
4. Insulating materials suitable for natural gas.
5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

## 2.9 SLEEVES

- 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.

## 2.10 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
  - 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 Company (The).
    - d. Pipeline Seal and Insulator, Inc.
  - 2. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe and sleeve.
  - 3. Pressure Plates: Carbon steel].
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one nut and bolt for each sealing element.

## 2.11 ESCUTCHEONS

- A. General Requirements for Escutcheons: Manufactured wall and ceiling escutcheons and floor plates, with ID to fit around pipe or tube, and OD that completely covers opening.
- B. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Escutcheons: With set screw.
  - 1. Finish: Polished chrome-plated.

## 2.12 LABELING AND IDENTIFYING

- A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of **6 inches (150 mm)** wide and **4 mils (0.1 mm)** thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to **30 inches (750 mm)** deep; colored yellow.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54 and the International Fuel Gas Code requirements for prevention of accidental ignition.

### 3.3 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- 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. Locate valves for easy access.
- F. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install escutcheons at penetrations of interior walls, ceilings, and floors.
  - 1. New Piping:
    - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    - b. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - c. Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
    - d. Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - e. Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type and set screw.
    - f. Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated finish.
    - g. Piping in Equipment Rooms: One-piece, cast-brass type.
    - h. Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

- J. 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 in Division 07 Section "Through Penetration Firestopping Systems."
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
  - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches (75 mm) long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
  - 1. Above Accessible Ceilings: Natural-gas piping, fittings, valves, and regulators may be installed in accessible spaces without containment conduit.
  - 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
    - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
  - 3. Prohibited Locations:
    - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
    - b. Do not install natural-gas piping in solid walls or partitions.
- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 (DN 50) and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

- V. Install pressure gage upstream and downstream from each line regulator. Pressure gages are specified in Division 22 Section "Meters and Gages for Plumbing Piping."

### 3.4 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

### 3.5 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
  - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
  - 2. Cut threads full and clean using sharp dies.
  - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
  - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
  - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
  - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
  - 2. Bevel plain ends of steel pipe.
  - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
  - 1. **NPS 1 (DN 25) and Smaller:** Maximum span, **96 inches (2438 mm)**; minimum rod size, **3/8 inch (10 mm)**.
  - 2. **NPS 1-1/4 (DN 32):** Maximum span, **108 inches (2743 mm)**; minimum rod size, **3/8 inch (10 mm)**.
  - 3. **NPS 1-1/2 and NPS 2 (DN 40 and DN 50):** Maximum span, **108 inches (2743 mm)**; minimum rod size, **3/8 inch (10 mm)**.
  - 4. **NPS 2-1/2 to NPS 3-1/2 (DN 65 to DN 90):** Maximum span, **10 feet (3 m)**; minimum rod size, **1/2 inch (13 mm)**.

5. **NPS 4 (DN 100) and Larger:** Maximum span, **10 feet (3 m)**; minimum rod size, **5/8 inch (15.8 mm)**.
- C. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:
  1. **NPS 3/8 (DN 10):** Maximum span, **48 inches (1220 mm)**; minimum rod size, **3/8 inch (10 mm)**.
  2. **NPS 1/2 (DN 15):** Maximum span, **72 inches (1830 mm)**; minimum rod size, **3/8 inch (10 mm)**.
  3. **NPS 3/4 (DN 20) and Larger:** Maximum span, **96 inches (2440 mm)**; minimum rod size, **3/8 inch (10 mm)**.

### 3.7 CONNECTIONS

- A. Connect to utility's gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.
- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within **72 inches (1800 mm)** of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

### 3.8 LABELING AND IDENTIFYING

- A. Comply with requirements in Division 22 Section "Identification for Plumbing Piping and Equipment" for piping and valve identification.
- B. Install detectable warning tape directly above gas piping, **12 inches (300 mm)** below finished grade, except **6 inches (150 mm)** below subgrade under pavements and slabs.

### 3.9 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
  1. Alkyd System: MPI EXT 5.1D.
    - a. Prime Coat: Alkyd anticorrosive metal primer.
    - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
    - c. Topcoat: Exterior alkyd enamel (semigloss).
    - d. Color: Gray.

- C. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

### 3.10 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.11 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be one of the following:
  - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be the following:
  - 1. Steel pipe with wrought-steel fittings and welded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

### 3.12 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG (3.45 kPa)

- A. Aboveground, branch piping NPS 1 (DN 25) and smaller shall be the following:
  - 1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping.
  - 2. Annealed-temper, tin-lined copper tube with flared joints and fittings.
  - 3. Annealed-temper, copper tube with wrought-copper fittings and flared joints.
  - 4. Aluminum tube with flared fittings and joints.
  - 5. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be one of the following:
  - 1. Steel pipe with malleable-iron fittings and threaded joints.
  - 2. Steel pipe with wrought-steel fittings and welded joints.
- C. Underground, below building, piping shall be the following:
  - 1. Corrugated stainless-steel tubing with integral vented jacket with vent tee fittings, threaded ends to match adjacent piping. Provide one continuous length of piping under the floor with no joints.

### 3.13 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 (DN 50) and smaller at service meter shall be the following:
  - 1. Bronze plug valve.



- B. Valves for pipe sizes **NPS 2-1/2 (DN 65)** and larger at service meter shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- C. Distribution piping valves for pipe sizes **NPS 2 (DN 50)** and smaller shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- D. Distribution piping valves for pipe sizes **NPS 2-1/2 (DN 65)** and larger shall be [one of] the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.
- E. Valves in branch piping for single appliance shall be the following:
  - 1. Two-piece, full-port, bronze ball valves with bronze trim.

END OF SECTION 221613

## SECTION 230500 – COMMON WORK RESULTS FOR HVAC

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Provide labor, materials, accessories, and other related items as required to complete operations in connection with the complete installation of the HVAC and mechanical systems as indicated on the Drawings and as specified herein.

#### 1.2 RELATED REQUIREMENTS

- A. Conditions of the contract apply to the work, including the work of this Division. Examine Contract Documents for requirements affecting the work.

#### 1.3 MECHANICAL PRE-CONSTRUCTION MEETING

- A. Conduct a mechanical conference at Project site to comply with requirements of Division 01 Section “Project Management and Coordination” and the following:
  - 1. At least 14 days prior to beginning of mechanical work, conduct a meeting to review detailed requirements for mechanical systems installation and testing requirements. Review mechanical Drawings and Specifications, discuss project specific details and requirements, and review and discuss expectations for quality control. Establish preliminary work progress schedule and procedures for materials inspection, testing, and certifications. Require representatives of each entity directly concerned with mechanical systems installation to attend conference, including, but not limited to, the following:
    - a. General Contractor's superintendent.
    - b. Mechanical Subcontractors' project managers.
    - c. Mechanical Subcontractors' job foremen.
    - d. Sheetmetal job foreman.
    - e. Controls job foreman.
    - f. Project mechanical Engineer/designer.
    - g. Job clerk.
    - h. Architect's construction administrator.

#### 1.4 DRAWINGS

- A. The general location of the apparatus and the details of the work are indicated on the Drawings. Exact locations not indicated shall be determined at the site as the work progresses and shall be subject to the Architect's approval.
- B. It is not intended that the Drawings shall show every pipe, pipe rise, pipe drop, duct rise, duct drop, pipe fitting, duct fitting, or appliance, but it shall be a requirement to furnish, without additional expense, material and labor necessary to complete the systems in accordance with the design intent and with the highest possible quality available.

## 1.5 ALTERATIONS

- A. Execute alterations, additions, removals, relocations, new work, and other related items as indicated or required to provide a complete installation in accordance with the intent of the Contract Documents, including changes required by building alterations.
- B. Existing work disturbed or damaged by the alterations or the new work shall be repaired or replaced to the Architect's satisfaction and at no additional cost to the Owner.
- C. Existing ductwork, piping, and other systems indicated to be removed, shall be removed from the site. Cap off existing services remaining. The Owner retains the right to ownership of heating and ventilating equipment scheduled to be removed; store such equipment where requested by the Owner. Material not retained by the Owner shall be removed from the site.

## 1.6 CONTINUITY OF SERVICE

- A. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted service for the building or any of its locations. Any unavoidable conditions requiring reduced building capacity shall be arranged for by programming with the Owner's duly authorized representative at the building subject to the Architect's approval. If necessary, temporary work shall be installed to provide for the condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal service shall be performed during an overtime period to be scheduled with the Owner. Costs for overtime work shall be included in the bid.

## 1.7 REQUIREMENTS

- A. Installation Instructions: Obtain manufacturer's printed installation instructions to aid in properly executing work on major pieces of equipment. Install equipment in accordance with manufacturer's recommendations.
- B. Objectionable Noise, Fumes and Vibration:
  - 1. Mechanical and electrical equipment shall operate without creating objectionable noise, fumes, or vibration, as determined by the Architect.
  - 2. If such objectionable noise, fumes, or vibration is produced and transmitted to occupied portions of building by apparatus, piping, ducts, or any other part of mechanical and electrical work, make necessary changes and additions, as approved, without extra cost to Owner.
- C. Equipment Design and Installation:
  - 1. Uniformity: Unless otherwise specified, equipment or material of same type or classification, used for same purposes, shall be product of same manufacturer.
  - 2. Design: Equipment and accessories not specifically described or identified by manufacturer's catalog number shall be designed in conformity with ASME, IEEE, or other applicable technical standards, suitable for maximum working pressure, and with neat and finished appearance.
  - 3. Installation: Erect equipment aligned, level and adjusted for satisfactory operation. Install so that connecting and disconnecting of piping and accessories can be made readily, and so that parts are easily accessible for inspection, operation, maintenance and repair. Minor deviations from indicated arrangements may be made, as approved.

- D. Hanging of Equipment, Ductwork and Piping:
  - 1. Support equipment, ductwork and piping from the top chord of bar joists at the “Panel Points” or from the top flange of beams. Piping 2" (51 mm) nominal and smaller may be supported from the bottom chord of the bar joists at the APanel Points@ or from the bottom flange of the beams.
- E. Protection of Equipment and Materials: Responsibility for care and protection of materials and mechanical work rests with the Contractor until the entire project has been completed, tested and the project is accepted by the Owner.
- F. Foundations:
  - 1. Ceiling Mounting: Where ceiling mounting is indicated or specified, use suspended platform or strap hangers, bracket or shelf, whichever is most suitable for equipment and its location. Construct of structural steel members, steel plates, or rods, as required; brace and fasten to building structure or to inserts as approved, or as detailed.
  - 2. Where floor mounting is indicated, locate equipment on 4 inch (102 mm) high reinforced concrete pad of adequate size with anchors and base plates as required, on pressure-treated sleepers, or on structural steel frame as detailed. The corners of pads shall be chamfered 1/2 inch (13 mm). Pad and steel sizes and location shall be coordinated with the approved equipment.

#### 1.8 ELECTRIC WORK

- A. Provide motors, pilot lights, controllers, limit switches, and other related items for equipment provided under Division 23.
- B. Except as noted, required line switches, fused switches, and other related items and necessary wiring to properly connect equipment to motors and switches shall be furnished and installed under Division 26, Electric.
- C. Provide complete wiring system for automatic temperature controls as specified under Section Division 23 Section “Instrumentation and Controls for HVAC.”
- D. Wiring shall conform to the requirements of the National Electrical Code.

#### 1.9 FIRESTOPPING

- A. Firestopping for penetrations of ductwork, piping and equipment through fire rated and smoke rated building assemblies, including but not limited to partitions, walls, floors, ceilings, and roofs, shall be furnished and installed under this Section.
- B. Selection of firestopping materials and installation of firestopping materials shall be in accordance with Division 07 Section “Through Penetration Firestopping Systems.” Coordinate with other trades for a consistent installation.
- C. Refer to Architectural Drawings for locations of fire rated building assemblies.

#### 1.10 SUBMITTALS

- A. After award of Contract and before installation, submit for approval Shop Drawings, bulletins, Product Data, Samples, and other related items.

- B. Submit Shop Drawings and Product Data as required in each Section. Submittal shall include physical data and performance data required to verify compliance with the Contract Documents.
- C. Submit Samples and Mock-Ups as required in each Section, and as indicated on the Drawings. These will generally be retained by the Architect/Engineer. Contractor may request these items returned; provide return shipping for returns.

#### 1.11 SUBSTITUTIONS

- A. Comply with provisions of the Instructions to Bidders and General Requirements.
- B. The first item listed under "Acceptable Manufacturers", "Approved Manufacturers" or "Manufacturers" is the design basis.
  - 1. Other manufacturers listed may be used in the base bid, but conformance with details of the Specifications, as well as dimensional and electrical data, shall be verified by the Contractor.
  - 2. Architect/Engineer has not verified that each listed manufacturer has the ability to provide an acceptable substitution for the basis-of-design product. Contractor may not assume that substitutions will be approved.
  - 3. Modifications required as a result of differences between the design basis item and the submitted and approved item must be approved by the Architect and made at the Contractor's expense. As an example, if a rooftop HVAC unit is submitted and approved and if the unit's dimensions and weight are different from those of the unit which was used as the design basis, the Contractor shall be responsible for building structural modifications required to accommodate the submitted and approved unit, at no additional cost to the Owner.
  - 4. For items which have no manufacturers listed, any item conforming with the Contract Documents is acceptable.
- C. Substitutions from manufacturers or providers which are not listed may be proposed within the time allowed in the General Conditions of the Specifications.
  - 1. The exception to this is products for which the list of manufacturers or providers is limited by the wording "no substitutions" or similar wording.

#### 1.12 COORDINATION

- A. Coordinate scheduling, submittals, and Work of the various Sections of Specifications to assure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Verify that utility requirement characteristics of operating equipment are compatible with building utilities. Coordinate work of various Divisions having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate space requirements and installation of mechanical and electrical work which are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with line of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- D. In finished areas, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Coordinate completion and clean-up of work of separate Sections in preparation for Substantial Completion.
- F. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

#### 1.13 REQUESTS FOR ARCHITECT'S CADD DRAWINGS

- A. In lieu of generating their own CADD drawings, the Contractor may elect to use the Architect's electronic copies of CADD drawings for the purpose of developing control system graphics or for other reasons that pertain to the requirements of this Contract. If the Contractor elects to utilize the Architect's electronic copies of CADD drawings, the electronic files shall be purchased from the Architect at the Architect's current billing rate per drawing. The Contractor shall provide payment and shall sign a release-of-liability form before electronic CADD drawings are released.

#### 1.14 SEISMIC DESIGN

- A. This project requires special provisions for the support and restraint of piping, ductwork and equipment. These provisions shall be incorporated in accordance with the following:
  1. The requirements of this Section are complementary to requirements listed elsewhere for the fastening and support of piping, ductwork, and equipment. Nothing indicated on the Drawings or in other Sections of these Specifications shall be interpreted as a reason to waive the requirements of this Section.
  2. Piping, ductwork and equipment shall be adequately supported and restrained to resist seismic forces in accordance with section 301.15 of the 2009 International Mechanical Code and with chapter 16 of the 2009 International Building Code and associated supplements.
  3. Seismic restraints for piping and ductwork:
    - a. Piping and ductwork not listed as exempt from the requirements for seismic restraints shall be seismically restrained in accordance with the following publications:
      - 1) Sheet Metal and Air Conditioning Contractors National Association (SMACNA) SEISMIC RESTRAINT MANUAL GUIDELINES FOR MECHANICAL SYSTEMS, Second Edition - 1998
      - 2) APPENDIX E - Sheet Metal and Air Conditioning Contractors National Association (SMACNA) SEISMIC RESTRAINT MANUAL GUIDELINES FOR MECHANICAL SYSTEMS, Second Edition - 1998
  4. Seismic Restraints for Equipment:
    - a. Engage the services of a licensed professional engineer (hereinafter known as the Engineering Specialist) with experience in the field of equipment support and seismic restraints. The Engineering Specialist shall select and coordinate the restraints and supports based on the final coordinated drawings showing exact locations of equipment and shall coordinate with the project Structural Engineer to ascertain that the connections to the structure will resist the horizontal forces to which they might be subjected. Submit details and calculations from the

Engineering Specialist as required to demonstrate compliance. Equipment that shall be considered in the Engineering Specialist's seismic design shall include, but not be limited to the following:

- 1) Pumps (under Alternate #2)
  - 2) Air Handling Units
5. Provide floor-mounted equipment with approved seismic control devices as required to prevent overturning or movement. Seismic devices shall be capable of keeping equipment captive under seismic loads.
  6. Provide suspended equipment with approved seismic control devices as required to maintain the equipment in a captive attitude under seismic loads.
  7. The following shall be exempt from requirements for seismic restraints:
    - a. Piping suspended by individual hangers 12 inches (305 mm) or less from the top of the pipe to the supporting structure.
    - b. In Mechanical rooms, piping with less than 1-1/4" (32 mm) nominal inside diameter.
    - c. In areas other than Mechanical rooms, piping with less than 2-1/2" (64 mm) nominal inside diameter.
    - d. Ductwork that is suspended by hangers 12 inches (305 mm) or less from the top of the duct to the supporting structure.
    - e. Ductwork that has a cross-sectional area less than 6 square feet (0.56 m<sup>2</sup>).

#### 1.15 CLEANING

- A. Remove debris from site daily.
- B. Material and pieces of equipment shall be turned over to the Owner free of dust and dirt, both inside and out.
- C. At the completion of the Project, equipment shall have a clean, neat appearance of factory finish by cleaning or repainting as required.
- D. At the completion of the Project, surfaces exposed to view shall have a clean, neat appearance of finish free from smudges and scratches by cleaning or repainting as required.

#### 1.16 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Architect/Engineer seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible manufacturer's representative in accordance with manufacturer's instructions.

- G. When specified in individual Specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

#### 1.17 FACTORY START-UP AND START-UP REPORTS

- A. Provide factory start-up of mechanical equipment listed below. Factory start-up shall be performed by a factory authorized representative of the equipment manufacturer. When factory start-up is successfully completed for each piece of mechanical equipment listed below, submit a formal start-up report to the Architect for approval. Start-up report shall be formatted in accordance with equipment manufacturer's recommendations. Start-up report shall be typed, not hand written, and shall be submitted in a clean and legible form.
- B. Equipment requiring factory start-up
  1. Packaged Rooftop Air Conditioner
  2. Energy Recovery Ventilator
  3. Condensing Gas-Fired Boiler

#### 1.18 ADJUSTMENTS AND OWNER'S INSTRUCTIONS

- A. After completion of the installation work called for in the Contract Documents, furnish necessary mechanics or engineers for the adjustment and operation of the systems, to the end that the systems are perfectly adjusted and turned over to the Owner in perfect working order. Further instruct the Owner's authorized representative in the care and operation of the installation, providing framed instruction charts, directions, and other related items.
- B. Instructors providing Owner training shall be experienced and familiar with the jobsite.

#### 1.19 TESTING

- A. After the entire installation is completed and ready for operation, test the systems as outlined in Division 01 Section "Testing, Adjusting and Balancing for HVAC." These tests are supplementary to detailed tests specified herein or directed. The Owner will provide water and electric current for the test. Provide necessary labor, test pump, gauges, meters, other instruments, and materials. Perform tests in the presence of the Architect or his representative.
- B. Perform other tests specified in individual Sections of this Specification.

#### 1.20 COMPLETION OF SYSTEMS

- A. The following mechanical systems shall not be complete until the following conditions are satisfied:
  1. Ductwork Systems:
    - a. Ductwork and related components and accessories shall be completely installed and insulated as specified.
    - b. Ductwork leakage testing shall be completed and leakage testing reports shall be



- submitted and approved.
  - c. Ductwork shall be balanced and a balancing report shall be submitted and approved.
- 2. Piping Systems:
  - a. Piping, valves and accessories shall be completely installed, insulated and labeled as specified.
  - b. Piping pressure testing be completed and pressure testing reports shall be submitted and approved.
  - c. Piping systems shall be balanced and a balancing report shall be submitted and approved.
- 3. Equipment:
  - a. Equipment, including but not limited to classroom unit ventilators, pumps air handling units, shall be completely installed.
  - b. Equipment start-up reports shall be completed, submitted and approved.
  - c. Equipment balancing shall be completed and the balancing report shall be submitted and approved.
- 4. Automatic Temperature Controls (ATC):
  - a. ATC system shall be completely installed.
  - b. Commissioning shall be completed.
  - c. ATC system shall operate in an automatic mode for a minimum of four (4) months during Owner occupancy without substantial deficiencies.

#### 1.21 OPERATING AND MAINTENANCE MANUALS

- A. Furnish two (2) bound operating and maintenance manuals and forward to the Architect for review and transmittal to the Owner.
- B. For maintenance purposes, provide approved Submittals, parts lists, specifications, and manufacturer's maintenance bulletins for each piece of equipment. For materials used which have been submitted to the Architect for approval but do not require regular maintenance, such as piping, ductwork, and insulation, provide one copy of approved Submittals.
- C. Provide name, address and telephone number of the manufacturer's representative and service company, for each piece of equipment or material so that service or spare parts can be readily obtained.

#### 1.22 WARRANTY

- A. Provide guarantees and warranties for work under this Contract as indicated in the general requirements of the Contract.
- B. Provide manufacturers= standard warranties and guarantees for work by the mechanical trades. However, such warranties and guarantees shall be in addition to and not in lieu of other liabilities which the manufacturer and the Mechanical Contractor may have by law or by other provisions of the Contract Documents.
- C. Guarantee that elements of the systems provided under this Contract are of sufficient capacity to meet the specified performance requirements as set forth in these Specifications or as indicated on the Drawings.
- D. Upon receipt of notice from the Owner of failure of any part of the mechanical systems or

equipment during the warranty period, the Mechanical Subcontractor shall replace the affected part or parts.

- E. Furnish a written guarantee covering the above requirements before submitting the application for final payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 230500

## SECTION 230513 – MOTORS, DRIVES, AND ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Common requirements for electric motors furnished on equipment specified in other Sections, including single phase and three phase electric motors.
- B. Starters.
- C. Thermal Overload Protection.
- D. Belt Drives.
- E. Variable Speed Drives.

#### 1.2 REFERENCES

- A. Division 01 for requirements for references and standards.
- B. AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- C. AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.
- D. NEMA MG 1 - Motors and Generators.
- E. NFPA 70 - National Electrical Code.
- F. UL 674 - UL Standard for Safety Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
- G. UL 1836 - UL Standard for Safety for Electric Motors for Use in Class I, Division 2 and Class II, Division 2 Hazardous (Classified) Locations.

#### 1.3 REGULATORY REQUIREMENTS

- A. Conform to UL Component Recognition for appropriate sizes.
- B. Conform to NFPA 70 and local energy code.

#### 1.4 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 for transport, handle, store, and protect products.
- B. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

## PART 2 - PRODUCTS

### 2.1 MOTORS

- A. Acceptable Manufacturers:
  - 1. A.O. Smith.
  - 2. Baldor.
  - 3. Emerson Motor Technologies.
  - 4. General Electric.
  - 5. Greenheck Fan Corporation.
  - 6. Marathon Electric.
  - 7. Siemens.
  - 8. Teco-Westinghouse.
  - 9. Toshiba.
  - 10. U.S. Motors (division of Emerson Motor Technologies).
  
- B. General Construction and Requirements:
  - 1. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these specifications.
  - 2. Motors shall have integral thermal overload protection.
  - 3. Single Phase Motors for general applications: PSC (permanent split capacitor) where available.
  - 4. Single Phase Motors for fans:
    - a. EC (electronically commutated) where available.
    - b. PSC (permanent split capacitor) where available, if EC is not available.
  - 5. Open drip-proof type except where specifically noted otherwise.
  - 6. Design for continuous operation in 40 degrees C environment.
  - 7. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
  - 8. Explosion-Proof Motors: UL approved for hazard classification.
  - 9. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.
  
- C. Inverter Duty: Motors for use with variable frequency drives shall be rated for  $A_{inverter}$  duty@, with winding insulation rated for 1600 volts and Class H (180°C) temperature rating.
  
- D. Single-Phase Power for Fans - Electronically-Commutated (EC) Motors - Also Known As Brush-Free DC (BFDC) Motors:
  - 1. Drive: Direct-drive only, not for use with belt drive.
  - 2. Power Supply: Internal motor circuitry shall convert AC power supplied to DC power to operate the motor.
  - 3. Turndown: Speed-controllable down to 20% of full speed (80% turndown).
  - 4. Speed Control: Integral potentiometer with screwdriver setting, remote potentiometer dial with 24 VDC transformer to generate a 0-10 VDC signal, or integral circuitry to accept a 0-10 VDC signal from the building control system, as indicated and specified.
  - 5. Efficiency: Minimum of 85% efficient at all speeds.
  - 6. Soft-start type, capable of reliable start at any speed setting.
  - 7. Enclosure: Open drip-proof.
  - 8. Bearings: Permanently lubricated heavy duty ball bearings.

9. Overload Protection:
  - a. Automatic Speed Control: In the event of overheating or overloading, the motor electronics slow the motor to operate within its acceptable range.
  - b. Thermal Overload: Internally fused, one-shot type as a last resort to prevent fires.
  - c. Locked Rotor: If the motor sees a locked rotor condition, it will automatically shut itself down, then try to restart 3 times. After the 3rd try, the motor will not attempt to restart until the power is cycled.
  
- E. Single Phase Power - Permanent-split Capacitor Motors:
  1. Starting Torque: Exceeding one fourth of full load torque.
  2. Starting Current: Up to six times full load current.
  3. Multiple Speed: Through tapped windings.
  4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.
  
- F. Single Phase Power - Capacitor Start Motors:
  1. Starting Torque: Three times full load torque.
  2. Starting Current: Less than five times full load current.
  3. Pull-up Torque: Up to 350 percent of full load torque.
  4. Breakdown Torque: Approximately 250 percent of full load torque.
  5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
  6. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated bearings.
  7. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.
  
- G. Single Phase Power - Split Phase Motors:
  1. Starting Torque: Less than 150 percent of full load torque.
  2. Starting Current: Up to seven times full load current.
  3. Breakdown Torque: Approximately 200 percent of full load torque.
  4. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
  5. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.
  
- H. Three Phase Power - Squirrel-cage Motors:
  1. Starting Torque: Between 1 and 1-1/2 times full load torque.
  2. Starting Current: Six times full load current.
  3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
  4. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B energy-efficient motors.
  5. Insulation System: NEMA Class B or better.
  6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
  7. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000

- hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
8. Sound Power Levels: To NEMA MG 1.
  9. Part Winding Start Above 254T Frame Size: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
  10. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
  11. Nominal Efficiency: To NEMA MG 1, energy efficient for motor sizes 10 and larger.

## 2.2 STARTERS AND OVERLOADS

- A. Acceptable Manufacturers:
  1. Siemens.
  2. Allen-Bradley (division of Rockwell Automation).
  3. Cerus Industrial, Inc.
  4. Cutler Hammer (division of Eaton Corporation).
  5. General Electric.
  6. Square D (division of Schneider Electric).
  
- B. Motor starters shall be furnished for motors provided under this Section of these specifications. Each 3 phase motor starter shall have a 3-pole type, three element overload device and shall have "ON-AUTO-OFF" switch in cover plate. They shall be general purpose NEMA rated for connected H.P. (definite purpose starters not acceptable) and shall have control power with fused transformers as required. Coordinate control voltage with Controls Contractor. Provide auxiliary contacts where required for interlocking of electrical equipment. Provide two-speed motor starters where indicated.
  1. Single phase motors shall have one of the following factory wired methods of motor protection:
    - a. Integral thermal overload protection in motor and cord with plug and receptacle in unit casing.
    - b. Integral thermal overload protection in motor and disconnecting switch mounted in or on casing as specified with equipment.
    - c. Switch with thermal overload protection for unprotected motors with switch serving as disconnect device.
  
- C. Thermal overload devices shall be sized for motor nameplate full load amps or field measured amp draw, whichever is less. Replace elements as required by field measurements.
  
- D. For starters associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the starter enclosure to interface with the building's fire alarm system. Upon receipt of a signal from the building's fire alarm system, power to load side of the starter shall be turned off. Circuitry shall be provided to ensure that power is off whether the starter is in the "AUTO", "HAND" or "BYPASS" mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements of division 16.
  
- E. At Contractor's option, Cerus Industrial "BAS" building automation HVAC starters may be provided. Features of starters/contactors, disconnects, and temperature controls may be

combined in a single package using these starters. Coordination with Automatic Temperature Controls supplier and installer is recommended to reduce total project costs. Features include:

1. Multi-tap control power transformer (CPT) for universal control voltage.
2. Motor circuit protector disconnect (MCP) with high interrupt rating and lockable operator handle.
3. Contactors rated as high as 2.5 million electrical operations and 25 million mechanical operations.
4. Anti-cycling feature.
5. Solid-state electronic overloads with wide adjustment range and highly accurate digital motor protection, including protection for phase loss, phase unbalance, stall and locked rotor conditions. Class 1-30.
6. Digital keypad, featuring an H-O-A (Hand, Off , Auto) panel with large, clearly labeled push buttons including a front panel reset function and high-intensity LED indicators for settings.
7. Damper and valve actuator control, to open the actuator before starting the fan or pump motor.
8. Permissive auto control to disable auto inputs. Commonly used with a high pressure limit switch.
9. Universal control inputs, including auto dry input, and wet input for voltages from 20 to 138 VAC or VDC.
10. Power failure reset.
11. Fireman's override.
12. NEMA 1 enclosure with prepunched knockouts. NEMA 3R, 4, 4X, and 12 as required.
13. BACnet embedded communications option available.
14. UL Listed assembly.
15. 5-year warranty.

## 2.3 V-BELT DRIVES

- A. Provide self-aligning roller-bearings mounted in sealed housings with grease fittings and grease overflow valves. Fan wheels and shafts shall be designed for critical speed at least 20% higher than the maximum fan speed. The assembled fan shall be statically and dynamically balanced at the factory. Bearings shall be certified to have an average life per AFBMA of not less than 200,000 hours.
- B. Provide adjustable belt drives for motors. Belts and pulleys shall be designed for a minimum 1.5 safety factor. The base shall be constructed to allow adjustment of belt tension without having to loosen motor hold-down bolts.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Division 01 for Quality Requirements": Manufacturer's instructions.
- B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.
- C. Check line voltage and phase and direction of rotation, and ensure agreement with nameplate.
- D. Install guards in accordance with Codes and OSHA requirements.

END OF SECTION 230513



## SECTION 230519 – METERS AND GAUGES FOR HVAC PIPING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Pressure gauges and Pressure gauge taps.
- B. Static pressure gauges.
- C. Test Plugs.
- D. Thermometers and thermometer wells.

#### 1.2 RELATED SECTIONS

- A. Division 23 Section “Hydronic Piping.”
- B. Division 23 Section “Instrumentation and Controls for Mechanical Systems.”

#### 1.3 REFERENCES

- A. Division 01 for requirements for references and standards.
- B. ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.
- C. ASME MFC-3M - Measurement of Fluid Flow in Pipes Using Orifice, Nozzle and Venturi.
- D. ASTM E1 - Standard Specification for ASTM Thermometers.
- E. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.
- F. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
- G. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
- H. AWWA C702 - Cold-Water Meters - Compound Type.
- I. AWWA C703 - Cold-Water Meters - Fire-Service Type.
- J. AWWA C706 - Direct-Reading Remote-Registration Systems for Cold-Water Meters.
- K. AWWA C710 - Cold-Water Meters - Displacement Type, Plastic Main Case.
- L. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
- M. UL 393 - Indicating Pressure Gauges for Fire-Protection Service.
- N. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

#### 1.4 SUBMITTALS

- A. Division 01 Section "Submittal Procedures": Procedures for submittals.
- B. Product Data: Provide manufacturers data and list which indicates use, operating range, total range, accuracy, and location for manufactured components.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 for "Closeout Procedures."
- B. Project Record Documents: Record actual locations of components and instrumentation.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01 for "Operation and Maintenance Data."
- B. Include instructions for calibrating instruments.

#### 1.7 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 for "Product Requirements": Environmental conditions affecting products on site.
- B. Do not install instruments when areas are under construction, except for required rough-in, taps, supports and test plugs.
- C. Supply two bottles of red gauge oil for static pressure gauges.

### PART 2 - PRODUCTS

#### 2.1 PRESSURE GAUGES

- A. Manufacturers:
  - 1. Weiss Series NF4S-1.
  - 2. Terice No. 600 Series.
  - 3. Marshalltown.
  - 4. Amtek.
  - 5. Dwyer.
- B. Gauge: Non-filled type, ANSI-ASME B40.1 Grade 1A, with bourdon tube, rotary brass movement, brass socket, 1/4" NPT connection, front recalibration adjustment, black scale on white-finished metal background.
  - 1. Case: 304 stainless steel.
  - 2. Lens: Push-in clear acrylic with stainless steel ring, per manufacturer=s standard.
  - 3. Bourdon Tube: Phosphor bronze.
  - 4. Dial Size: 4 to 4-1/2 inch (101 to 114 mm).
  - 5. Accuracy: One percent of full scale range.
  - 6. Scale: Psi.

7. Range: [0-60] psig typical, select for application.

C. Verify suitability of range for each application. Best selection is for typical reading to be close to mid-scale.

## 2.2 PRESSURE GAUGE TAPPINGS

A. Ball Valve:

1. Manufacturers:
  - a. Weiss.
  - b. Trerice.
  - c. Marshalltown.
  - d. Amtek.
  - e. Dwyer.
2. Brass, 1/4 inch (6 mm) NPT for minimum 300 psi, (2070 kPa).
3. Ball valves may also be furnished under applicable sections of the Specifications.

## 2.3 STATIC PRESSURE GAUGES

A. Dial Gauges:

1. Manufacturers:
  - a. Dwyer.
  - b. Trerice.
  - c. Marshalltown.
  - d. Amtek.
2. 3-1/2 inch (89 mm) diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

B. Inclined Manometer:

1. Manufacturers:
  - a. Dwyer.
  - b. Trerice.
  - c. Marshalltown.
  - d. Amtek.
2. Plastic with red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch (6 mm) diameter tubing.

## 2.4 TEST PLUGS

A. Test Plug:

1. Manufacturers:
  - a. Peterson Equipment Co., Inc., "Pete's Plugs". [[www.petesplug.com](http://www.petesplug.com)]
  - b. Weiss. [<http://weissinstruments.com/>]
  - c. Flow Design, Inc. [[www.flowdesign.com](http://www.flowdesign.com)]
  - d. Trerice. [<http://www.trerice.com/>]
2. 1/2 inch (13 mm) NPT brass fitting and cap for receiving 1/8 inch (3 mm) outside

diameter pressure or temperature probe with self-closing valves as follows:

- a. Nordel (EPDM) core for water and hydronic heating and cooling service, temperatures range 30 to 275°F (-1 to 176°C).
  - b. Neoprene core for natural gas or LP gas service, temperature range -40 to 150°F (-40 to 65°C).
  - c. Verify core suitability for other fluids and temperatures.
3. Working Pressure: 500 psig
  4. Cap Retaining Strap: Color coded to indicate core material.
  5. Construction with either dual self-closing valves (Pete's Plug standard design) or single valve are allowed.
  6. For chilled water applications, provide "XL" plugs which include a 1-1/2" (38 mm) extension for insulated piping.

B. Pressure and Temperature Test Kit: Furnish one (1) to the Owner.

1. Carrying case with inside foam padding.
2. Pressure gauge, liquid filled with 1/4" (6 mm) NPT connection, range 0 to 100 psig (0 to 700 kPa), with gauge adapter attached.
3. Additional gauge adapter with 1/8" (3 mm) diameter probe and protecting shield.
4. Bimetal thermometer, range 25 to 125°F (-5 to 50°C), 5 inch (127 mm) stem, 1-3/4 inch (44 mm) dial, external calibration.
5. Bimetal thermometer, range 0 to 220°F (-17 to 104°C), 5 inch (127 mm) stem, 1-3/4 inch (44 mm) dial, external calibration.
6. If extended "XL" plugs are used, provide the XL test kit which is suitable for any length of plug.

## 2.5 THERMOMETERS - DIAL

A. Manufacturers:

1. Weiss.
2. Terice.
3. Amtek.
4. Ernst.

B. Thermometer: Weiss Model 45VA, ASTM E1, stainless steel or cast aluminum case, adjustable angle with front recalibration, vapor actuated, black scale on white-finished metal background, black pointer, sealed lens, brass stem.

1. Size: 4 to 4-1/2 inch (101 to 114 mm) dial.
2. Lens: Snap-in Lexan polycarbonate with o-ring, or clear glass with rubber ring.
3. Bulb: Copper. Provide extended bulb for socket extension in insulated pipe.
4. Extended Bulb: Where required, provide extended capillary tube with braided copper protection.
5. Connection: Separable socket.
6. Accuracy: 1 scale division throughout range.
7. Calibration: Degrees F.
8. Scale Range: 30 to 240°F (0 to 115°C) for hot water heating, and supply air systems.
9. Graduations: 2°F.
10. Air Duct Flange: Provide for duct applications.

## 2.6 THERMOMETER SUPPORTS

- A. Socket (Thermometer Well) for Piping: Brass separable sockets for thermometer stems, with extensions for insulated piping. Provide with Honeywell viscous heat transfer paste.
- B. Flange for Duct: 3 inch (76 mm) outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Use ball valves for water service.
- B. Division 01 - Quality Requirements: Manufacturer's instructions.
- C. Install one pressure gauge per pump, with taps on suction and discharge of pump; pipe to gauge.
- D. Install gauge taps in piping; refer to Division 23 Section "Hydronic Piping"
- E. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches (64 mm) for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
- F. Fill thermometer sockets with heat transfer paste.
- G. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.
- H. Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.
- I. Coil and conceal excess capillary on remote element instruments.
- J. Provide instruments with scale ranges selected according to service with largest appropriate scale.
- K. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
- L. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.
- M. Locate test plugs where indicated.
- N. Provide pressure gauge at high point of system for setting of cold water make-up pressure reducing valve.

END OF SECTION 230519

## SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe and equipment hangers and supports.
- B. Equipment bases and supports.
- C. Sleeves and seals.

#### 1.2 RELATED SECTIONS

- A. Division 03 Section “Cast-In-Place Concrete”: Equipment bases.
- B. Division 07 Section “Through-Penetration Firestop Systems”: Joint seals for piping and duct penetration of fire rated assemblies.
- C. Division 23 Section “HVAC Piping Insulation.”
- D. Division 23 Section “Hydronic Piping.”

#### 1.3 REFERENCES

- A. ASME B31.1 - Power Piping.
- B. ASME B31.2 - Fuel Gas Piping.
- C. ASME B31.5 - Refrigeration Piping.
- D. ASME B31.9 - Building Services Piping.
- E. ASTM A653 G90 SS Gr. 33 - Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot Dipped Process.
- F. ASTM B633 - Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
- G. ASTM C642 - Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.
- H. ASTM C672 - Test Methods for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
- I. ASTM D412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- J. ASTM D395 - Standard Test Methods for Rubber Property - Compression Set.
- K. ASTM D573 - Test Method for Rubber - Deterioration in an Air Oven.
- L. ASTM D746 - Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

- M. ASTM D2240 - Test Method for Rubber Property - Durometer Hardness.
- N. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- O. MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
- P. MSS SP69 - Pipe Hangers and Supports - Selection and Application.
- Q. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.
- R. NFPA 13 - Installation of Sprinkler Systems.
- S. NFPA 14 - Installation of Standpipe and Hose Systems.
- T. NFPA 70 B National Electrical Code
- U. UL 203 - Pipe Hanger Equipment for Fire Protection Service.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures".
- B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
- C. Product Data: Provide manufacturers catalog data including load capacity.
- D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
- E. Manufacturer's Installation Instructions: Indicate special procedures and assembly of components.

#### 1.5 REGULATORY REQUIREMENTS

- A. Conform to applicable code for support of hydronic piping.
- B. Supports for Electrical: In conformance with NFPA 70.

### PART 2 - PRODUCTS

#### 2.1 HANGERS, SUPPORTS, & PIPE CLAMPS

- A. Approved Manufacturers (first manufacturer is basis of design):
  - 1. Strut Hangers:
    - a. Unistrut (division of Tyco).
    - b. Anvil International.
    - c. Cooper B-Line.
    - d. Hydra-Zorb Company.
    - e. Thomas & Betts - Superstrut line.
    - f. Tolco (division of Nibco).
  - 2. Adjustable Swivel Band Hangers:

- a. Carpenter & Paterson.
  - b. Anvil International.
  - c. Cooper B-Line.
  - d. Tolco (division of Nibco).
3. Clevis Hangers:
- a. Carpenter & Paterson.
  - b. Anvil International.
  - c. Cooper B-Line.
  - d. Tolco (division of Nibco).
4. J-Hangers:
- a. Carpenter & Paterson.
  - b. Cooper B-Line.
  - c. Thomas & Betts - Superstrut line.
  - d. Tolco (division of Nibco).
  - e. Unistrut (division of Tyco).
5. Cushion Clamps:
- a. Hydra-Zorb Company.
  - b. Cooper B-Line.
  - c. Thomas & Betts - Superstrut line.
  - d. Tolco (division of Nibco).
  - e. Unistrut (division of Tyco).
6. Insulated Pipe Couplings:
- a. Klo-Shure Corporation.
  - b. Cooper B-Line - Armafix line.
7. No substitutions.
- B. Horizontal Piping Supports: Provide struts for trapeze hangers for single or multiple pipes. Where individual piping runs are hung with individual hangers, adjustable swivel band hangers, clevis hangers, or j-hangers may be used.
- C. Strut hangers shall be standard 1-5/8"x1-5/8" size.
- D. Pipe hanger rods and nuts shall be plated to match the hangers. Nuts shall be self-locking type, or provide double nuts tightened to lock together. Rods shall be threaded one end, or continuous threaded. Provide washers at each nut.
- E. Cushion Clamps for Un-insulated Lines: Plastic cushion shall be Dupont Hytel plastic, 5555HS plastic elastomer, warranted from -40 F to 275 F.
- F. Copper-plated hangers are plated for identification only. Traditional thin copper plating on steel substrate does not provide adequate protection from galvanic corrosion due to contact between dissimilar metals.
- 1. Where copper-plated supports are specified for use with copper piping, either copper plating or a copper-colored finish such as Cooper B-Line's Dura-Copper epoxy coating is acceptable. This is for identification, and does not protect dissimilar metals.
  - 2. Where copper piping is used with steel hangers and supports, provide protection from galvanic corrosion such as thick plastic or vinyl factory coating, or plastic-lined cushion clamps.



- G. For Insulated Lines Clamped to Strut: Insulated pipe coupling insert with the same thickness as the insulation. Protects insulation from crushing, and provides continuous insulation and vapor barrier thru the hanger or clamp. Klo-Shure product provides plastic pipe support and rigid outer band, for field insulation into the coupling. Armafix product provides insulation with rigid outer band, for field insulation glued to the ends of the insert.

## 2.2 PIPE SUPPORTS

### A. Hydronic Piping:

1. Conform to ASME B31.9, ASTM F708, MSS SP58, MSS SP69 and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch (13 to 38 mm): Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 5 Inches (125 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Over: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes to 3 Inches (76 mm): Cast iron hook.
9. Wall Support for Cold Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 5 Inches (125 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

## 2.3 INSERTS

### A. Manufacturers:

1. Grinnell.
2. B-Line.

- B. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

## 2.4 SLEEVES

- A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gauge (1.2 mm) thick galvanized steel.
- B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gauge (1.2 mm) thick galvanized steel.

- C. Sleeves for Pipes Through Fire Rated and Fire Resistive Floors and Walls, and Fire Proofing: Prefabricated fire rated sleeves including seals, UL listed.
- D. Sleeves for Round Ductwork: Galvanized steel.
- E. Sleeves for Rectangular Ductwork: Galvanized steel.
- F. Stuffing or Firestopping Insulation: Glass fiber type, non-combustible.
- G. Sealant: Acrylic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

### 3.2 INSERTS

- A. Provide inserts for placement in concrete formwork.
- B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
- C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches (100 mm).
- D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
- E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

### 3.3 PIPE HANGERS AND SUPPORTS

- A. Support horizontal piping as scheduled.
- B. Install hangers to provide minimum 1/2 inch (13 mm) space between finished covering and adjacent work.
- C. Place hangers within 12 inches (300 mm) of each horizontal elbow.
- D. Use hangers with 1-1/2 inch (38 mm) minimum vertical adjustment.
- E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet (1.5 m) maximum spacing between hangers.
- F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.
- G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

- H. Support riser piping independently of connected horizontal piping.
- I. Provide copper plated hangers and supports for copper piping.
- J. Design hangers for pipe movement without disengagement of supported pipe.
- K. Prime coat exposed steel hangers and supports. Refer to Division 09 Section "Painting". Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- L. Do not support pipes from other pipes or equipment.
- M. Size pipe hangers to accommodate continuous piping insulation.

### 3.4 EQUIPMENT BASES AND SUPPORTS

- A. Provide housekeeping pads of concrete, minimum 4 inches (100 mm) thick and extending 6 inches (150 mm) beyond supported equipment, with 1-inch (25 mm) chamfered edges. Provide dowels to fasten pad to structural floor. Refer to Division 03. Unless otherwise shown or specified, floor-mounted major equipment shall be set on housekeeping pads and anchored to housekeeping pads. This shall include but not be limited to base mounted pumps (under Alternate #2).
- B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.
- C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.
- D. Provide rigid anchors for pipes after vibration isolation components are installed.
- E. Do not support equipment from pipes or from other equipment.

### 3.5 SLEEVES

- A. Set sleeves in position in formwork. Provide reinforcing around sleeves.
- B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.
- C. Extend sleeves through floors 1 inch (25 mm) above finished floor level. Caulk sleeves.
- D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk air tight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.
- E. Install chrome plated steel escutcheons at finished surfaces.

3.6 SCHEDULES

PIPE SIZE		HANGER ROD MAX. HANGER SPACING		DIAMETER	
Inches	(mm)	Feet	(m)	Inches	(mm)
<b>Steel and Copper Piping</b>					
1/2 to 1-1/4	12 to 32	6.5	2	3/8	9
1-1/2 to 2	38 to 50	10	3	3/8	9
2-1/2 to 3	62 to 75	10	3	1/2	13
4 to 6	100 to 150	10	3	5/8	15
8 to 12	200 to 300	14	4.25	7/8	22
14 and Over	350 and Over	20	6	1	25
<b>Polypropylene Piping</b>					
1/2 to 2-1/2	12 to 64	4	1.2	3/8	9
3 and over	75 and over	6	1.8	3/8	9
PVC (All Sizes)		6	1.8	3/8	9
C.I. Bell and Spigot (or No-Hub) and at Joints		5	1.5	5/8	15

END OF SECTION 230529

## SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe Markers.

#### 1.2 REFERENCES

- A. Division 01 for “References”: Requirements for references and standards.
- B. ASME A13.1 - Scheme for the Identification of Piping Systems.
- C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

#### 1.3 SUBMITTALS

- A. Division 01 for “Submittal Procedures.”
- B. Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Samples: Submit two tags, 1-1/2 inches (38 mm) in size.
- F. Samples: Submit two labels, 1.9 x 0.75 inches (48 x 19 mm) in size.

#### 1.4 PROJECT RECORD DOCUMENTS

- A. Submit under Division 01 for “Closeout Procedures.”
- B. Record actual locations of tagged valves; include valve tag numbers.

#### 1.5 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01 for “Operation and Maintenance Data.”
- B. Include valve tag chart.

## PART 2 - PRODUCTS

### 2.1 NAMEPLATES

- A. Manufacturer: Seton Identification Products, a division of Tricor.
- B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

### 2.2 TAGS

- A. Metal Tags:
  - 1. Manufacturer: Seton Identification Products, a division of Tricor.
  - 2. Brass with stamped letters; tag size minimum 1-1/2 inches (38 mm) diameter with smooth edges.
- B. Information Tags:
  - 1. Manufacturer: Seton Identification Products, a division of Tricor.
  - 2. Clear plastic with printed "Danger," "Caution," or "Warning" and message; size 3-1/4 x 5-5/8 inches (83 x 143 mm) with grommet and self-locking nylon ties.
- C. Tag Chart: Typewritten letter size list in anodized aluminum frame with plexiglass cover.

### 2.3 PIPE MARKERS

- A. Color and Lettering: Conform to ASME A13.1.
- B. Plastic Pipe Markers:
  - 1. Manufacturer: Seton Identification Products, a division of Tricor.
  - 2. Factory fabricated, flexible, semi-rigid plastic, preformed to fit around pipe or pipe covering. Larger sizes may have maximum sheet size with spring fastener.
- C. Plastic Underground Pipe Markers:
  - 1. Manufacturer: Seton Identification Products, a division of Tricor.
  - 2. Bright colored continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mil (0.10 mm) thick, manufactured for direct burial service.

### 2.4 CEILING TACKS

- A. Manufacturer: Seton Identification Products, a division of Tricor.
- B. Description: Steel with 3/4 inch (19 mm) diameter color coded head.
- C. Color code as follows:
  - 1. HVAC Equipment: Yellow.
  - 2. Fire Dampers/Smoke Dampers: Red.
  - 3. Heating/Cooling Valves: Blue.

## 2.5 LABELS

- A. Manufacturer: Seton Identification Products, a division of Tricor.
- B. Description: Polyester, size 1.9 x 0.75 inches (48 x 19 mm), adhesive backed with printed identification.

## 2.6 LOCKOUT DEVICES

- A. Lockout Hasps:
  - 1. Manufacturer: Seton Identification Products, a division of Tricor.
  - 2. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches (184 x 76 mm).
- B. Valve Lockout Devices:
  - 1. Manufacturer: Seton Identification Products, a division of Tricor.
  - 2. Nylon device preventing access to valve operator, accepting lock shackle.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.
- B. Prepare surfaces in accordance with Division 09 Section "Painting" for stencil painting.

### 3.2 INSTALLATION

- A. Division 01 for "Quality Requirements": Manufacturer's instructions.
- B. Install identifying devices after completion of coverings and painting.
- C. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive.
- D. Install labels with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer. For unfinished canvas covering, apply paint primer before applying labels.
- E. Install tags using corrosion resistant chain. Number tags consecutively by location.
- F. Identify items of mechanical equipment such as air handling units, pumps and heat transfer equipment with plastic nameplates. Small devices, such as in-line pumps, may be identified with tags.
- G. Identify control panels and major control components outside panels with plastic nameplates.
- H. Identify valves in main and branch piping with metal tags.
- I. Tag automatic controls, instruments, and relays. Key to control schematic.

- J. Identify piping, concealed or exposed, with plastic pipe markers. Use tags on piping 3/4 inch (20 mm) diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet (6 m) on straight runs including risers and drops, at each branch and riser take-off, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.
- K. Identify duct access doors at fire dampers, smoke dampers, and smoke detectors with 1/2-inch (12.7 mm) lettering to indicate the fire protection device(s) within, in accordance with NFPA 90A.
- L. Provide ceiling tacks to locate valves, dampers and equipment above T-bar type panel ceilings. Locate in corner of panel closest to equipment.
- M. Secure valve tag chart on an easily accessible wall in the mechanical room or in a location as otherwise directed by the Architect.

### 3.3 COORDINATION WITH EXISTING EQUIPMENT

- A. Where an existing equipment identification system is involved, the new system shall be coordinated and compatible with the existing system.

END OF SECTION 230553



## SECTION 230713 – DUCT INSULATION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Ductwork Insulation.
- B. Insulation jackets.

#### 1.2 RELATED SECTIONS

- A. Division 09 Section “Painting”: Painting insulation jackets.
- B. Division 23 Section “Identification for HVAC Piping and Equipment.”
- C. Division 23 Section “Metal Ducts”

#### 1.3 REFERENCES

- A. Division 01 for: Requirements for references and standards.
- B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- C. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- D. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- E. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- F. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
- G. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
- H. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- I. ASTM C1071 - Standard Specification for Thermal and Acoustical Insulation (Glass Fiber, Duct Lining Material).
- J. ASTM C1482 - Standard Specification for Polyimide Flexible Cellular Thermal and Sound Absorbing Insulation.
- K. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

- L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- N. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
- O. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
- P. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- Q. NAIMA National Insulation Standards.
- R. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
- S. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- T. UL 94 - Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
- U. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

#### 1.4 SUBMITTALS

- A. Division 01 for “Submittal Procedures”.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years’ experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

#### 1.6 REGULATORY REQUIREMENTS

- A. Materials: Flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723.
- B. Insulation materials shall be asbestos free. No fibers with dimensions similar to asbestos fibers shall be released from any material.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 for “Product Requirements”: Transport, handle, store, and protect products.

- B. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- C. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

## 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 for "Product Requirements": Environmental conditions affecting products on site.
- B. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- C. Maintain temperature during and after installation for minimum period of 24 hours.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Glass and Mineral Fiber Products:
  - 1. Knauf Insulation.
  - 2. Certainteed Corporation.
  - 3. Johns Manville.
  - 4. Owens Corning.
  - 5. No substitutions.

### 2.2 GLASS FIBER, FLEXIBLE

- A. Insulation: ASTM C553; flexible, noncombustible blanket.
  - 1. 'K' ('Ksi') value: ASTM C518, 0.27 at 75°F (0.039 at 24°C).
  - 2. Maximum service temperature: 250°F (121°C) faced and 350°F (176°C) unfaced.
  - 3. Maximum moisture absorption: 0.20 percent by volume.
  - 4. Minimum density: 1.0 lb/cu.ft (16 kg/m<sup>3</sup>).
- B. Vapor Barrier Jacket:
  - 1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  - 2. Moisture vapor transmission: ASTM E96; 0.02 perm.
  - 3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- D. Tie Wire: Annealed steel, 16 gage (1.5 mm).

### 2.3 GLASS FIBER, RIGID

- A. Insulation: ASTM C612; rigid, noncombustible blanket.
  - 1. 'K' ('Ksi') value: ASTM C518, 0.24 at 75°F (0.036 at 24°C).
  - 2. Maximum service temperature: 450°F (232°C).

3. Maximum moisture absorption: 1.0 percent by volume.
  4. Density: 3.0 lb/cu ft (48 kg/cu m).
- B. Vapor Barrier Jacket:
1. Kraft paper with glass fiber yarn and bonded to aluminized film.
  2. Moisture vapor transmission: ASTM E96; 0.02 perm.
  3. Secure with pressure sensitive tape.
- C. Vapor Barrier Tape: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
- D. Indoor Vapor Barrier Finish:
1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight, glass fabric.
  2. Vinyl emulsion type acrylic, compatible with insulation, [black] [white] color.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Division 01 for "Project Management and Coordination": Verification of existing conditions before starting work.
- B. Verify that ductwork has been tested before applying insulation materials.
- C. Verify that surfaces are clean, foreign material removed, and dry.
- D. Verify that insulation materials are clean and dry. Discard any materials that exhibit signs of moisture damage, contamination, mold, mildew, or other biological growth. Discard any materials used in the air handling airstream if they have been exposed to water.

### 3.2 INSTALLATION

- A. Division 01 for "Quality Requirements": Manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. In addition to new ductwork, repair damaged existing insulation for surfaces of existing ductwork that is currently insulated.
- D. Provide insulation for surfaces of ductwork, as indicated and specified. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2001, State Energy Codes, and BOCA Energy Code requirements or Table I, whichever is greater. In addition, comply with the other requirements of this Section.
- E. Insulated Ductwork Conveying Air below Ambient Temperature:
  1. Provide insulation with vapor barrier jackets.
  2. Finish with tape and vapor barrier jacket.
  3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
  4. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections,

and expansion joints.

- F. Insulated Ductwork Conveying Air above Ambient Temperature:
  - 1. Provide with or without standard vapor barrier jacket.
  - 2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.
- G. Ductwork Exposed below 10 feet (3 meters) above finished floor in Mechanical Equipment Rooms or below 8 feet (2.4 meters) above finished floor in Finished Spaces: Provide glass fiber rigid insulation with vapor barrier jacket.
- H. Inspection Plates and Test Holes: Provide, where required, in ductwork or casings for balance measurements. Test holes shall be factory fabricated, airtight, and noncorrosive with screw cap and gasket. Extend cap through insulation.
- I. Install insulation after ductwork and equipment have been tested and approved.
- J. Ensure that surface is clean and dry prior to installation. Ensure that insulation is dry before and during application. Finish with system at operating conditions.
- K. Ensure that insulation is continuous through inside walls. Pack around ducts with fireproof self-supporting insulation material, properly sealed.
- L. Finish insulation neatly at hangers, supports and other protrusions.
- M. Locate insulation or cover seams in least visible locations.
- N. Repair separation of joints or cracking of insulation due to thermal movement or poor workmanship.
- O. Do not insulate exposed ductwork in conditioned spaces or ductwork that is acoustically lined, unless otherwise specified or indicated on the Drawings.
- P. Standing seams, supporting angles and flanges on insulated ductwork shall be insulated with thickness equal to the duct and edges shall be finished and vapor sealed.
- Q. Mechanical fasteners shall not be riveted or screwed to the duct and shall not penetrate the metalwork.
- R. For supply or return ductwork which is required to be insulated, insulation shall be continuous and shall include the insulating of register, grille and diffuser connection plenums/boots.

### 3.3 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to Specifications. Inspect installations progressively for compliance with requirements.

TABLE I  
DUCTWORK INSULATION MATERIAL AND WALL THICKNESS

DUCTWORK TYPE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS
Supply ductwork for heating only systems with supply air temperatures greater than or equal to 100EF	Glass Fiber, Flexible	No	2" (50.8 mm)
	Glass Fiber, Rigid	No	2" (50.8 mm)
Supply ductwork for heating only systems with supply air temperatures less than 100EF	Glass Fiber, Flexible	No	1 1/2" (38.1 mm)
	Glass Fiber, Rigid	No	1" (25.4 mm)
Supply Ductwork for heating and cooling systems with heating supply air temperatures greater than or equal to 100EF	Glass Fiber, Flexible	Yes	2" (50.8 mm)
	Glass Fiber, Rigid	Yes	2 layers of 1" (25.4 mm) with staggered joints
Supply ductwork for heating and cooling systems with heating supply air temperatures less than 100EF	Glass Fiber, Flexible	Yes	1 1/2" (38.1 mm)
	Glass Fiber, Rigid	Yes	1" (25.4 mm)
Exposed supply ductwork in mechanical or equipment rooms	Glass Fiber, Rigid	Yes	1" (25.4 mm)

END OF SECTION 230713

## SECTION 230719 – HVAC PIPING INSULATION

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.
- C. Shields, Inserts, and Saddles.

#### 1.2 RELATED SECTIONS

- A. Division 07 Section “Through Penetration Firestop Systems.”
- B. Division 23 Section “Identification for HVAC Piping and Equipment.”
- C. Division 23 Section “Hydronic Piping”

#### 1.3 REFERENCES

- A. Division 01 for “References”: Requirements for references and standards.
- B. ASTM A167 - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]).
- D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus.
- E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement.
- F. ASTM C240 - Standard Test Methods of Testing Cellular Glass Insulation Block.
- G. ASTM C449/C449M - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement.
- H. ASTM C518 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
- I. ASTM C533 - Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
- J. ASTM C534 - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
- K. ASTM C547 - Standard Specification for Mineral Fiber Preformed Pipe Insulation.

- L. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation.
  - M. ASTM C578 - Standard Specification for Preformed, Cellular Polystyrene Thermal Insulation.
  - N. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyurethane Thermal Insulation.
  - O. ASTM C610 - Standard Specification for Expanded Perlite Block and Pipe Thermal Insulation.
  - P. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - Q. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - R. ASTM D1056 - Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.
  - S. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
  - T. ASTM D1667 - Standard Specification for Flexible Cellular Materials-Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam).
  - U. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  - V. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics.
  - W. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
  - X. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
  - Y. NAIMA National Insulation Standards.
  - Z. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.
  - AA. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.
- 1.4 SUBMITTALS
- A. Submit under provisions of Division 01 for “Submittal Procedures”.
  - B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.
- 1.5 QUALITY ASSURANCE
- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.



- B. Applicator Qualifications: Company specializing in performing the work of this section with minimum three years experience.

#### 1.6 REGULATORY REQUIREMENTS

- A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E84, NFPA 255 and UL 723. For elastomeric foam insulation, rating shall apply for thicknesses up to 1 inch (25 mm).
- B. Insulation materials and accessories shall be asbestos-free. No fibers with dimensions similar to asbestos fibers shall be released from any material.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 for "Product Requirements": Transport, handle, store, and protect products.
- B. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

#### 1.8 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 for "Product Requirements": Environmental conditions affecting products on site.
- B. Maintain ambient conditions required by manufacturers of each product.
- C. Maintain temperature before, during, and after installation for minimum of 24 hours.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Glass and Mineral Fiber Products:
  - 1. Knauf Insulation.
  - 2. Certaineed Corporation.
  - 3. Johns Manville.
  - 4. Owens Corning.
  - 5. No substitutions.
- B. Accessories:
  - 1. Ceel-Co division of Johns Manville (product: plastic jacket systems).
  - 2. Foster Products, division of Specialty Construction Brands, Inc., a subsidiary of H.B. Fuller (mastics, sealants, reinforcing membranes, and accessories).
  - 3. Johns Manville (products: Super-Seal acrylic polymer coatings).
  - 4. Pabco/Childers Metals, division of ITW Insulation Systems (products: metal jacket systems, and accessories).
  - 5. Pittsburgh Corning (product: cellular glass insulation for high-density inserts).
  - 6. Vac Systems International (product: Tough Coat acrylic polymer mechanical insulation repair coating).

#### 2.2 GLASS FIBER

- A. Insulation: ASTM C547; rigid molded, noncombustible.
  - 1. 'K' ('Ksi') value: ASTM C177, 0.24 Btu-in/(hr-sq.ft-°F) at 75°F (0.035 W/m-K at 24°C).
  - 2. Maximum service temperature: 850°F (454°C).
  - 3. Maximum moisture absorption: 0.2 percent by volume.
- B. Vapor Barrier Jacket:
  - 1. ASTM C921, White kraft paper with glass fiber yarn, bonded to aluminized film.
  - 2. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
- C. Tie Wire: 0.048 inch (1.22 mm) stainless steel with twisted ends on maximum 12 inch (300 mm) centers.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.
- E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- F. Indoor Vapor Barrier Finish:
  - 1. Cloth: Untreated; 9 oz/sq yd (305 g/sq m) weight.
  - 2. Vinyl emulsion type acrylic, compatible with insulation, white color.
- G. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- H. Outdoor Breather Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
- I. Insulating Cement: ASTM C449/C449M.

## 2.3 JACKETS

- A. PVC Plastic.
  - 1. Jacket: ASTM D1784, One piece molded type fitting covers and sheet material, off-white color.
    - a. Minimum service temperature: 0°F (-18°C).
    - b. Maximum service temperature: 150°F (66°C).
    - c. Moisture vapor transmission: ASTM E96; 0.002 perm-inches.
    - d. Thickness: 15 mil (0.38 mm) for indoor use.
    - e. Connections: Brush on welding adhesive, tacks (for heating systems only) or pressure sensitive color matching vinyl tape.
  - 2. Covering Adhesive Mastic: Compatible with insulation.

## 2.4 SHIELDS, INSERTS, AND SADDLES:

- A. Shields:
  - 1. Carpenter and Paterson Figure 265GS, or equal.
  - 2. Galvanized or electro-galvanized steel, minimum 12 inch length, minimum 120-degree arc, minimum 18 gauge.
  - 3. Provide contact adhesive to glue shields to the insulation.
- B. Snap-On Shields:
  - 1. Cooper B-Line "Snap'N Shield".

2. Snap-N Shield is an acceptable substitute for metal shields when installed with strut trapeze hangers on horizontal piping.
3. Paintable polypropylene plastic 12-inch long preformed shields, snap-on design for attachment to strut.
4. Gluing is not required with Snap-N Shield.
5. Provide black or white color to match the insulation in areas exposed to public view.

C. Inserts:

1. Configuration: Minimum 6 inches (150 mm) long, of same thickness and contour as adjoining insulation; may be factory fabricated.
2. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

D. Saddles:

1. Factory fabricated of curved carbon steel plate, of same overall thickness and contour as adjoining insulation. Sides designed for welding to pipe. Center support plate for pipe sizes 12 inches (300 mm) and larger.

## 2.5 MANUFACTURER'S STAMP OR LABEL

- A. Every package or standard container of insulation, jackets, cements, adhesives, and coatings delivered to the project site for use shall have the manufacturer's stamp or label attached giving name of manufacturer, brand, and description of material. Insulation packages and containers shall be asbestos-free.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

### 3.2 INSTALLATION

- A. Division 01 for "Quality Requirements": Manufacturer's instructions.
- B. Install in accordance with NAIMA National Insulation Standards.
- C. Provide insulation for surfaces of new piping and for surfaces of existing piping where the existing insulated has been damaged. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2007 and International Energy Code requirements or Table I, whichever is greater. In addition, comply with the other requirements of this Section.
- D. Piping systems requiring insulation, types of insulation required, and insulation thickness shall be as listed in Table I herein. For piping not listed in Table 1, insulate to meet Code requirements, using suitable specified materials, subject to Architect's approval. Except for flexible unicellular insulation, insulation thicknesses as specified in Table I shall be one inch (25 mm) greater for insulated piping systems located outside the building and in unconditioned spaces. Unless otherwise specified, insulate fittings, flanges, and valves, except valve stems,

hand wheels, and operators. Use factory pre-molded, precut, or field-fabricated insulation of the same thickness and conductivity as used on adjacent piping. Insulation exterior shall be factory cleanable, grease resistant, non-flaking, and non-peeling.

- E. Exposed Piping: Locate insulation and cover seams in least visible locations.
- F. Insulated Pipes Conveying Fluids Below Ambient Temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- G. Glass Fiber Insulated Pipes Conveying Fluids below Ambient Temperature:
  - 1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
  - 2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.
- H. For hot piping conveying fluids 140°F (60°C) or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- I. For hot piping conveying fluids over 140°F (60°C), insulate flanges and unions at equipment.
- J. Glass Fiber Insulated Pipes Conveying Fluids above Ambient Temperature:
  - 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
  - 2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- K. Shields, Inserts, and Saddles:
  - 1. Application: Provide shields at hangers. Provide inserts for piping 2 in. (50 mm) nominal size or larger. Provide saddles for piping 6 in. (150 mm) nominal size and larger and for generator exhaust piping and muffler.
  - 2. Shield location: Between insulation jacket and hanger.
  - 3. Insert location: Between support shield and piping and under the finish jacket.
  - 4. Saddle location: Between support shield and piping.
  - 5. Tack-weld saddles to the pipe or muffler. Fill air spaces within the saddle with insulation material.
  - 6. Glue shields to outside of insulation after system is filled and run at operating temperature.
  - 7. Align mid-length of shields, inserts, and saddles with the hanger centerline.
- L. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Division 7.
- M. Pipe Exposed in Mechanical Equipment Rooms 10 feet (3 meters) or less above finished floor: Finish with PVC jacket and fitting covers.
- N. Pipe Exposed in Finished Spaces 10 feet (3 meters) or less above finished floor: Finish with PVC jacket and fitting covers.

### 3.3 UNIFORM INSTALLATION

- A. Systems shall use a single insulation type throughout the installation.

### 3.4 PREPARATION

- A. Insulate piping after system tests have been completed and surfaces to be insulated have been cleaned of dirt, rust, and scale and dried. Ensure full range of motion of equipment actuators. Modify insulation to avoid obstruction of valve handles, safety reliefs, and other components requiring movement. Allow adequate space for pipe expansion. Install insulation with jackets drawn tight and cement down on longitudinal and end laps. Do not use scrap pieces where a full length section will fit. Insulation shall be continuous through sleeves, wall and ceiling openings. Extend surface finishes to protect surfaces, ends, and raw edges of insulation. Apply coatings and adhesives at the manufacturer's recommended coverage per gallon. Individually insulate piping. Provide a moisture and vapor seal where insulation terminates against metal hangers, anchors and other projections through the insulation on surfaces for which a vapor seal is specified. Keep insulation dry during the application of any finish. Bevel and seal the edges of exposed insulation. Unless otherwise indicated, do not insulate the following:
  1. Piping in radiation enclosures, or within cabinets of unit heaters.
  2. Valve hand wheels.
  3. Fire protection pipes.
  4. Vibration isolating connections.
  5. Adjacent insulation.
  6. ASME stamps.

### 3.5 PIPING INSULATION

- A. Pipe Insulation (Except Elastomeric and Hydrous Calcium Silicate Insulation): Place sections of insulation around the pipe and joints tightly butted into place. The jacket laps shall be drawn tight and smooth. Secure jacket with fire resistant adhesive, factory applied self sealing lap. Cover circumferential joints with butt strips, not less than 3-inches (76 mm) wide, of material identical to the jacket material. Overlap longitudinal laps of jacket material not less than 1-1/2 inches (38 mm). Adhesive used to secure the butt strip shall be the same as used to secure the jacket laps. When a vapor barrier jacket is required, as indicated in Table I, or on the ends of sections of insulation that butt against flanges, unions, valves, fittings, and joints, use a vapor-barrier coating conforming to manufacturer's weatherproof coating for outside service. Apply this vapor barrier coating at longitudinal and circumferential laps. Patch damaged jacket material by wrapping a strip of jacket material around the pipe and cementing, and coating as specified for butt strips. Extend the patch not less than 1-1/2 inches (38 mm) past the break in both directions. At penetrations by pressure gauges and thermometers, fill the voids with the vapor barrier coating for outside service. Seal with a brush coat of the same coating. Where penetrating roofs, insulate piping to a point flush with the top of the flashing and seal with the vapor barrier coating. Butt tightly the exterior insulation to the top of the flashing and interior insulation. Extend the exterior metal jacket 2 inches (51 mm) down beyond the end of the insulation. Seal the flashing and counterflashing underneath with the vapor barrier coating.
- B. Seal surfaces of fibrous insulation to prevent release of fibers.
- C. Sleeves and Wall Chases: Where penetrating interior walls, extend a metal jacket 2-inches out on either side of the wall and secure on each end with a band. Where penetrating floors, extend

a metal jacket from a point below the back-up material to a point 10-inches above the floor with one band at the floor and one not more than one inch from end of metal jacket. Where penetrating exterior walls, extend the metal jackets through the sleeve to a point 2-inches beyond the interior surface of the wall.

3.6 FIELD INSPECTION

- A. Visually inspect to ensure that materials used conform to specifications. Inspect installations progressively for compliance with requirements.

TABLE I  
PIPING INSULATION MATERIAL AND WALL THICKNESS

SERVICE	INSULATION MATERIAL	VAPOR BARRIER REQUIRED	INSULATION WALL THICKNESS AT THE FOLLOWING PIPE DIAMETERS					
			<1"	1" to <1.5"	1.5" to <4"	4" to <8"	8" or Greater	
Heating Systems (Hot Water Supply and Return)								
	Fluid Design Operating Temperature Range							
	Above 350EF	Glass Fiber	Yes	2.5"	3.0"	3.0"	4.0"	4.0"
		Hydrous Calcium Silicate	No	2.5"	3.0"	3.0"	4.0"	4.0"
	251EF to 350EF	Glass Fiber	Yes	1.5"	2.5"	3.0"	3.0"	3.0"
	201EF to 250EF	Glass Fiber	Yes	1.5"	1.5"	2.0"	2.0"	2.0"
	141EF to 200EF	Glass Fiber	Yes	1.0"	1.0"	1.0"	1.5"	1.5"
	105EF to 140EF	Glass Fiber	Yes	0.5"	0.5"	1.0"	1.0"	1.0"

END OF SECTION 230719

## SECTION 230900 - INSTRUMENTATION AND CONTROL FOR MECHANICAL 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. This Section includes control equipment for HVAC and Plumbing systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.
- B. IB Controls shall reuse existing controls components and equipment to the greatest extent possible to minimize the amount of new equipment that would need to be purchased.**

#### 1.3 DEFINITIONS

- A. Note: The terms ATC, BAS, and DDC may be used interchangeably in this Section and on the Drawings, to indicate the overall control system.
- B. Definitions:
  - 1. ATC: Automatic temperature control.
  - 2. BACnet: A control network technology platform for designing and implementing interoperable control devices and networks.
  - 3. BAS: Building Automation System.
  - 4. DDC: Direct digital control.
  - 5. I/O: Input/output.
  - 6. MS/TP: Master slave/token passing.
  - 7. PC: Personal computer.
  - 8. PID: Proportional plus integral plus derivative.
  - 9. RTD: Resistance temperature detector.

#### 1.4 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
  - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
  - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
  - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
  - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
  - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.

6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.
7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
  - a. Water Temperature: Plus or minus 1 deg F (0.5 deg C).
  - b. Water Flow: Plus or minus 5 percent of full scale.
  - c. Water Pressure: Plus or minus 2 percent of full scale.
  - d. Space Temperature: Plus or minus 1 deg F (0.5 deg C).
  - e. Ducted Air Temperature: Plus or minus 1 deg F (0.5 deg C).
  - f. Outside Air Temperature: Plus or minus 2 deg F (1.0 deg C).
  - g. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
  - h. Pressure Differential: Plus or minus 1 percent of full scale.
  - i. Air Pressure (Ducts): Plus or minus 0.1-inch wg (25 Pa).
  - j. Electrical: Plus or minus 5 percent of reading.

## 1.5 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
  1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
  2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
  3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- 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. Bill of materials of equipment indicating quantity, manufacturer, and model number.
  2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
  3. Wiring Diagrams: Power, signal, and control wiring.
  4. Details of control panel faces, including controls, instruments, and labeling.
  5. Written description of sequence of operation.
  6. Schedule of dampers including size, leakage, and flow characteristics.
  7. Schedule of valves including size and flow characteristics.
  8. DDC System Hardware:
    - a. Wiring diagrams for control units with termination numbers.
    - b. Schematic diagrams and floor plans for field sensors and control hardware.
    - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
  9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.



10. Controlled Systems:
  - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
  - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
  - c. Written description of sequence of operation including schematic diagram.
  - d. Points list.
  
- C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE Standard 135 (BACnet).
  
- D. Software and Firmware Operational Documentation: Include the following:
  1. Software operating and upgrade manuals.
  2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
  3. Device address list.
  4. Printout of software application and graphic screens.
  5. Software license required by and installed for DDC workstations and control systems.
  
- E. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
  
- F. Qualification Data: For Installer and manufacturer.
  
- G. Field quality-control test reports.
  
- H. Operation and Maintenance Data: For mechanical instrumentation and control system to include in emergency, operation, and maintenance manuals. Include the following:
  1. Maintenance instructions and lists of spare parts for each type of control device.
  2. Interconnection wiring diagrams with identified and numbered system components and devices.
  3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
  4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
  5. Calibration records and list of set points.

## 1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
  
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  
- C. Comply with ASHRAE Standard 135 (BACnet) for DDC system components.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, provide shipping of control devices to equipment manufacturer, in a timely manner coordinated with the equipment manufacturer.
- B. Components to be Installed Under Other Sections: For components to be installed under other Sections of the Specifications, provide delivery of components to appropriate Subcontractors, provide installation instructions, and supervise their installation.
- C. System Software: Update to latest version of software at Project completion.

## 1.8 COORDINATION

- A. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- B. Coordinate equipment with Division 26 Section "Fire Alarm Systems" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- D. Coordinate line-voltage power supplies with Division 26.

## 1.9 EXTRA MATERIALS

- A. (Not Used.)

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE SUPPLIERS

- A. Acceptable Manufacturers and Installers:
  - 1. Basis of Design: Delta, installed by IB Controls, 3 Pope Road, Windham, ME 04062
  - 2. No other substitutions will be permitted.
- B. System components shall generally be the products of a single manufacturer(s) listed above. Where manufacturers are listed in paragraphs below, those lists shall apply to their specific products only. Miscellaneous components which the control system manufacturer doesn't manufacture such as cabling, conduits, transformers, and ice cube relays may be products of other manufacturers, subject to approval.
- C. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in a multi-user, multitasking environment on a token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.

### 2.2 UNACCEPTABLE BIDDERS

## INSTRUMENTATION AND CONTROL FOR MECHANICAL SYSTEMS

- A. Bids by wholesalers, contractors or franchised dealers or any other firm whose principal business is not that of manufacturing or installing automatic temperature control systems or of those not listed above shall not be acceptable. Bid documents that are not complete in their response to these documents or take exception to any of the capabilities defined within these documents will be rejected.

## 2.3 DDC EQUIPMENT

- A. Operator Workstation: Communicate back to existing operator workstation.
- B. Application Software:
  - 1. Existing operating system shall be upgraded to latest control system.
  - 2. I/O capability from operator station.
  - 3. System security for each operator via software password and access levels.
  - 4. Automatic system diagnostics; monitor system and report failures.
  - 5. Database creation and support.
  - 6. Automatic and manual database save and restore.
  - 7. Dynamic color graphic displays.
  - 8. Custom graphics generation and graphics library of Mechanical equipment and symbols.
  - 9. Alarm processing, messages, and reactions.
  - 10. Trend logs retrievable in spreadsheets and database programs.
  - 11. Alarm and event processing.
  - 12. Object and property status and control.
  - 13. Automatic restart of field equipment on restoration of power.
  - 14. Data collection, reports, and logs. Include standard reports for the following:
    - a. Current values of objects.
    - b. Current alarm summary.
    - c. Disabled objects.
    - d. Alarm lockout objects.
    - e. Logs.
  - 15. Custom report development.
  - 16. Utility and weather reports.
  - 17. Workstation application editors for controllers and schedules.
  - 18. Maintenance management.
- C. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
  - 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
  - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
    - a. Global communications.
    - b. Discrete/digital, analog, and pulse I/O.
    - c. Monitoring, controlling, or addressing data points.
    - d. Software applications, scheduling, and alarm processing.
    - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
  - 3. Standard Application Programs:

- a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
  - b. Mechanical Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
  - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
  - d. Remote communications.
  - e. Maintenance management.
  - f. Units of Measure: Inch-pound and SI (metric).
4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
5. ASHRAE 135 (BACnet) Compliance: Control units shall use BACnet protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
- 1. Binary Inputs: Allow monitoring of on-off signals without external power.
  - 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
  - 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
  - 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
  - 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
  - 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
  - 7. Universal I/Os: Provide software selectable binary or analog outputs.
- E. Any temperature control panels required in addition to those indicated on the Drawings shall be powered by the ATC Subcontractor.
- F. Wall mounted thermostats and temperature sensors shall be attached either to a wall stud or to blocking, or to an electrical wall box attached to such wall framing. Attaching to gypsum wallboard only shall not be allowed.
- G. Outdoor air temperature sensor(s) shall be installed on the North side of the building.
- 1. Thermostats and temperature sensors are shown on the drawings for general location. Terminal heat transfer units and fans which control space temperature shall be provided with thermostatic control, whether or not a thermostat or temperature sensor has been shown on the drawings
- H. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
- 1. Output ripple of 5.0 mV maximum peak to peak.
  - 2. Combined 1 percent line and load regulation with 100-microsecond response time for 50 percent load changes.

3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- I. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
    1. Minimum dielectric strength of 1000 V.
    2. Maximum response time of 10 nanoseconds.
    3. Minimum transverse-mode noise attenuation of 65 dB.
    4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

## 2.4 SPARE POINTS

- A. Provide a minimum of 10% spare points or 16 spare points, whichever is greater, in each ATC control panel for future use. Spare points shall be equally distributed among analog input, analog output, digital input and digital output. It is not intended that spare points be provided in unitary control panels which serve classroom unit ventilators. It is intended that spare points be provided in master control panels and in panels which serve mechanical rooms and air handling units.

## 2.5 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
  1. Accuracy: Plus or minus 0.5 deg F (0.3 deg C) at calibration point.
  2. Wire: Twisted, shielded-pair cable.
  3. Insertion Elements in Ducts: Single point, 8 inches (200 mm) long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft. (0.84 sq. m).
  4. Averaging Elements in Ducts: 36 inches (915 mm) long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft. (1 sq. m).
  5. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches (64 mm).
  6. Room Sensor Cover Construction: See below.
  7. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
  8. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
- C. Pressure Transmitters/Transducers:
  1. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Duct Static-Pressure Range: 0- to 5-inch wg (0 to 1240 Pa).
  2. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig (1034-kPa) operating pressure and tested to 300-psig (2070-kPa); linear output 4 to 20 mA.
  3. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.

- D. Room Sensor Cover Construction: Manufacturer's standard locking covers.
  - 1. Set-Point Adjustment: Concealed.
  - 2. Set-Point Indication: Concealed.
  - 3. Thermometer: Concealed.
  - 4. Communications Port: Standard phone-type jack for connection of portable laptop computer and other devices. Provide at each room sensor, no exceptions.
  - 5. Override Pushbutton: For timed override of occupied/unoccupied cycle. Provide in normally-occupied rooms such as classrooms and offices only.
  
- E. Room sensor accessories include the following:
  - 1. Insulating Bases: For sensors located on exterior walls.
  - 2. Adjusting Key: As required for calibration and cover screws. Furnish to the Owner, at least 5 per sensor type.
  - 3. Wall Mounting Box: Recessed, steel, securely fastened to wall framing. Equal to Steel City metallic switch boxes by Thomas & Betts Corp. Box may only be omitted where sensor attaches directly to masonry construction.

## 2.6 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg (0 to 1240 Pa).
- B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- G. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

## 2.7 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
  - 1. Comply with requirements in Division 23 Section "Motors, Drives & Accessories."
  - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in

- housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
  4. Spring-Return Motors for Valves Larger Than NPS 2-1/2 (DN 65): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
  5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running torque of 150 in. x lbf (16.9 N x m) and breakaway torque of 300 in. x lbf (33.9 N x m).
  6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft. (2.3 sq. m): Size for running and breakaway torque of 150 in. x lbf (16.9 N x m).
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
1. Manufacturers:
    - a. Belimo.
  2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
  3. Dampers: Size for running torque calculated as follows:
    - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
    - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. (62 kg-cm/sq. m) of damper.
    - c. Dampers with 2- to 3-Inch wg (500 to 750 Pa) of Pressure Drop or Face Velocities of 1000 to 2500 fpm (5 to 13 m/s): Increase running torque by 1.5.
    - d. Dampers with 3- to 4-Inch wg (750 to 1000 Pa) of Pressure Drop or Face Velocities of 2500 to 3000 fpm (13 to 15 m/s): Increase running torque by 2.0.
  4. Coupling: V-bolt and V-shaped, toothed cradle.
  5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
  6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
  7. Power Requirements (Two-Position Spring Return): 24-V ac.
  8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
  9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
  10. Temperature Rating: 40 to 104 deg F (5 to 40 deg C).
    - a. In addition, valve actuators shall be suitable for the anticipated ambient temperature and fluid temperature. For example, actuators located within heating equipment terminal enclosures will experience higher temperatures.
  11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F (Minus 30 to plus 121 deg C).
  12. Run Time: 30 seconds.
  13. Actuator Housing: Molded or die-cast zinc or aluminum. Terminal unit actuators may be high-impact plastic with ambient temperature rating of 50 to 140 deg F (10 to 60 deg C) unless located in return-air plenums.
  14. Damper actuators shall be provided with end switches.

## 2.8 CONTROL VALVES

- A. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.

1. Globe-type valves are required except for those applications where terminal-unit control valves or butterfly valves are specified or detailed.
  2. Ball-type valves may be substituted for other types, and shall be manufactured by Belimo, with Belimo actuators (no substitutions).
  3. Valves shall be suitable for water with up to 50% inhibited ethylene or propylene glycol.
  4. 3-way valves shall be mixing pattern, except where diverting pattern is specified, or where manufacturer requires use of diverting pattern.
  5. Rubber-paddle or ball-plug type control valves such as, but not limited to, Honeywell Fan-Coil Valves or the TAC Erie product line (division of Schneider Electric) are not allowed.
  6. Valves with thermal-wax motors are not allowed.
  7. Valves requiring cartridge replacement for service are not allowed.
  8. Valves requiring special water treatment such as 50-micron filtration are not allowed.
- B. Sizing: Maximum pressure drop determined with valve full-open at design flow rate and the following:
1. Two Position: Line size.
  2. Two-Way Modulating: Between one-half and one times the variable-flow load pressure drop, but not to exceed 3 psig (21 kPa).
  3. Three-Way Modulating: Between one-half and one times the variable-flow load pressure drop, but not to exceed 1.5 psig (10.5 kPa).
  4. Note: For modulating valves, the load pressure drop is that across the modulated portion of the system. For example, for a 3-way valve providing reset-water control at a boiler, the modulated flow is across the boiler and accessories, whereas the building loop to terminal equipment is considered constant-flow for the purposes of this valve's sizing. For a 3-way valve modulating the flow thru a coil, the coil and its pipe fittings comprise the variable-flow load. For a 3-way valve in a primary-secondary loop to a coil, where the flow thru the coil is a constant pumped flow, the variable load is in the primary-secondary bridge.
- C. Hydronic system globe valves shall have the following characteristics:
1. NPS 2 (DN 50) and Smaller: Class 125 bronze (or red brass) body, bronze or brass seat, bronze trim, rising stainless steel stem, renewable brass or composition disc or plug, screwed ends, with backseating capacity, repackable under pressure. Valve may have integral union ends. Valves with ends other than threaded or factory-integral unions are not allowed.
  2. NPS 2-1/2 (DN 65) and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
  3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
    - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
    - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
  4. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics through one of the ports, equal percentage through the other.
  5. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for 2-way valves, and 100 percent of pressure differential across valve or 100 percent of total system (pump) head for 3-way valves.
  6. Temperature Rating: 250 deg F (121 deg C).



## 2.9 DAMPERS

### A. Manufacturers:

1. Non-Insulated Dampers:
  - a. Ruskin - Model CD60.
  - b. American Warming & Ventilating.
  - c. Arrow.
  - d. Greenheck.
  - e. Tamco (T.A. Morrison & Co., Inc.).
2. Insulated-Blade Dampers:
  - a. T.A. Morrison & Co., Inc.; Tamco Series 9000 SC “Severe Cold Option” dampers.
  - b. Ventex, Inc. - Series 3965 SC.

### B. Non-Insulated Dampers:

1. AMCA-rated, parallel (two-position) or opposed-blade (modulating) design.
2. Frames shall be 16 ga. (1.6 mm) thick galvanized steel, reinforced to equivalent strength of 11 ga. (3 mm) galvanized steel; or 0.125 inch (3.2 mm) minimum thickness extruded-aluminum.
3. Blades shall be airfoil type of not less than 14 ga. (2 mm) equivalent thickness galvanized steel or heavy gauge extruded aluminum, with maximum blade width of 8 inches (200 mm) and length of 48 inches (1220 mm).
4. Secure blades to 1/2 inch (13 mm) diameter, hex-profile, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze or nylon blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
5. Operating Temperature Range: From -40 to 200 deg F (-40 to 93 deg C).
6. Edge Seals, Low-Leakage Applications: Replaceable, inflatable blade edging of Ruskiprene, neoprene, vinyl, or rubber, and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft (50 L/s per sq. m) of damper area, at differential pressure of 4-inch wg (1 kPa) when damper is held by torque of 50 in.-lbf (5.6 N-m); when tested according to AMCA 500D-98.

### C. Insulated Dampers: Dampers which are located in or 4 ft (1.2 m) or less from outside walls or roof lines, and are 8 sq. ft (0.74 sq. m) or larger, shall be thermally insulated type.

1. Frame: Extruded aluminum, externally insulated with polystyrene foam.
2. Blades: Double wall extruded aluminum, with internal injected polyurethane foam, thermally broken. Extruded silicone frame and blade seals, secured in slots in the aluminum extrusions. R-value of complete blade shall be 2.29 hr-sq. ft-deg F/Btu (0.39 sq. m-deg K/W).
3. Leakage shall not exceed 4.9 cfm per sq. ft (25 L per sq. m) against 4-inch wg (1kPa) differential static pressure at -40 deg F (-40 deg C).
4. Bearings: Celcon inner bearing fixed to a 7/16” (11.1 mm) aluminum hexagon blade pin, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.
5. Linkage Hardware: Installed in the frame side, constructed of aluminum and corrosion-resistant, zinc-plated steel, with cup-point trunnion screws for a slip-proof grip.
6. Operating Temperatures: -40 to 155 deg F (-40 to 68 deg C).
7. For dampers less than 12 inches (305 mm) in one dimension, provide “flanged-to-duct” mounting style for maximum free area.

- D. Automatic dampers at exterior wall louvers shall be 4 inches (100 mm) shorter in vertical dimension (height) than the louver they serve, to allow sloping of bottom of duct to drain outward.

## 2.10 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring shall be a minimum of cat 6.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that power supply and data outlet is available to control units and operator workstation.

### 3.2 INSTALLATION

- A. Install software in control units and operator workstation(s). Implement features of programs to specified requirements and as appropriate to sequence of operation.
- B. Connect and configure equipment and software to achieve sequence of operation specified.
- C. Provide interconnecting wiring to the communications jack on each room temperature sensor to allow full access to the ATC system from each room sensor.
- D. Verify location of room temperature sensors and other exposed control sensors with Drawings and room details before installation.
  - 1. Install devices 54 inches (1.37 m) above the floor where side approach is possible, and 48 inches (1.22 m) above the floor where front approach is required. Verify mounting heights with authorities having jurisdiction to comply with requirements of the Americans with Disabilities Act (ADA).
  - 2. Locate in the general location indicated, and coordinate to group together with room light switches and other devices of similar height, to minimize disruption of open wall space.
  - 3. Locate to not be above electrical dimmers.
  - 4. Locate to avoid heat-generating equipment such as computers, copiers, cooking equipment, coffee makers, vending machines, and refrigerators. Where electrical outlets are indicated near sensors, verify whether equipment is intended.
  - 5. Locate to avoid heating piping which may be concealed in partitions.
  - 6. Locate away from windows and exterior doors.
  - 7. Locate to avoid other false sources of heat such as strong sunlight.
- E. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- F. Provide guards on room sensors and thermostats in the following locations:
  - 1. Public areas other than classrooms and offices, including but not limited to: Corridors, hallways, entrances, lobbies, vestibules, stairwells, toilet rooms and storage rooms.
  - 2. Locations vulnerable to traffic.
  - 3. Where indicated.

- G. For components to be installed under other Sections of the Specifications, provide delivery of components to appropriate Subcontractors, provide installation instructions, and supervise their installation.
  - H. Install hydronic instrument wells, valves, and other accessories according to Division 23 Section "Hydronic Piping."
    - 1. Sensors shall be immersion type in wells unless otherwise specified or indicated.
    - 2. Enlarge piping at wells to prevent excess interference with flow.
    - 3. Locate wells to ensure insertion in active flowing section of piping or tank.
    - 4. Fill sensor wells with thermal heat transfer paste to ensure good conduction.
  - I. Install automatic dampers according to Division 23 Section "Air Duct Accessories."
  - J. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures. Provide stand-off brackets of depth to meet or exceed specified thickness of duct insulation.
  - K. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.
  - L. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."
  - M. Install electronic cables according to Division 26.
  - N. Unless otherwise indicated, actuators shall be spring loaded and shall, upon a loss of power, actuate their device to an appropriate Afail safe@ position.
    - 1. Hot water valves - fail safe to fully open.
    - 2. Outside and exhaust air dampers - fail safe to fully closed.
  - O. For actuators that are required to Afail safe@, provide spring return actuators. AFloating point@ actuators shall not be allowed for these applications. AFloating point@ actuators shall be allowed for actuators that are not required to Afail safe@.
- 3.3 INTERFACE WITH FIRE ALARM SYSTEM SHUT DOWN

- A. For equipment that is required to shut down upon a fire alarm condition, ensure that equipment is wired through input contacts within the starter enclosure to interface with the building's fire alarm system. Upon receipt of a signal from the building's fire alarm system, power to the load side of the starter shall be turned off. Provide circuitry to ensure that power is off whether the starter is in the AAUTO@, AHAND@ or ABYPASS@ mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contractor shall meet the requirements of Division 26.

### 3.4 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Provide electrical materials and installation under this Section. Requirements and standards shall be as specified in other Sections and Divisions of the Specifications, as indicated in paragraphs below.
- B. Install raceways, boxes, and cabinets according to Division 26.

- C. Install building wire and cable according to Division 26.
- D. Provide interface wiring (line and low voltage) as required to complete ATC system installation.
- E. Install signal and communication cable according to Division 26.
  - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
  - 2. Install exposed cable in raceway.
  - 3. Install concealed cable in raceway.
  - 4. Bundle and harness multi-conductor instrument cable in place of single cables where several cables follow a common path.
  - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
  - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
  - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- F. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- G. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.
- H. Connect fire alarm shutdown of motors on the load side of controls and hand-off-auto switches, to prevent motor from running in any switch position during fire alarm.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. 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 unit operation. Remove and replace malfunctioning units and retest.
  - 2. Test and adjust controls and safeties.
- C. DDC Verification:
  - 1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
  - 2. Check instruments for proper location and accessibility.
  - 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
  - 4. Check flow instruments. Inspect tag number and line and bore size, and verify that inlet side is identified and that meters are installed correctly.
  - 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
  - 6. Check temperature instruments and material and length of sensing elements.
  - 7. Check control valves. Verify that they are in correct direction.
  - 8. Check DDC system as follows:

- a. Verify that DDC controller power supply is from emergency power supply, if applicable.
  - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
  - c. Verify that spare I/O capacity has been provided.
  - d. Verify that DDC controllers are protected from power supply surges.
- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

### 3.6 ADJUSTING

#### A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
  - a. Check analog inputs at 0, 50, and 100 percent of span.
  - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
  - c. Check digital inputs using jumper wire.
  - d. Check digital outputs using ohmmeter to test for contact making or breaking.
  - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
  - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
  - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
  - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
  - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
  - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
  - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

#### B. Adjust initial temperature set points.

#### C. 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 three visits to Project during other than normal occupancy hours for this purpose.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Mechanical instrumentation and controls.

### 3.8 TRAINING

- A. Training shall be by the ATC Subcontractor and shall utilize specified manuals and as-built documentation. All training shall be video recorded, with the completed video being turned over to the owner once training has been completed.
- B. Operator training shall include 2 two-hour sessions encompassing:
  1. Modifying text.
  2. Sequence of Operation review.
  3. Selection of displays and reports.
  4. Use of the specified functions.
  5. Setting and adjusting of occupancy schedules.
  6. Troubleshooting of sensors.
  7. Owner questions/concerns.

## PART 4 - SEQUENCES OF OPERATION

### 4.1 GENERAL

- A. Setpoints shall be adjustable by the building operator through the graphic interface on the operator's workstation desktop PC, and through a portable laptop computer plugged into the system at locations throughout the building.
- B. Provide the ability for the Testing and Balancing Agent to connect to the system and change setpoints, to temporarily override setpoints, and to override modes of operation, as may be required for their work.

### 4.2 ALARMS

- A. Provide the capability to generate alarms, complete with individualized per point alarm message. Disable alarms when their associated system has been disabled as part of a standard control function. For example, when hot water system is inactive during the summer months and hot water temperature drops below the low water temperature alarm set point, do not generate an alarm.
- B. Environmental Alarms: Provide a digital output point to deliver an environmental alarm signal to the building's security system. Provide digital output point and associated wiring to the security panel. Final connection to security panel shall be by Division 26 (coordinate with Division 26). The environmental alarm shall be a single point. The following alarm conditions shall activate the environmental alarm:
  1. Low temperature (below 50 deg F) at each room temperature sensor
  2. Fan failure on fan coil units or ERV-1

### 4.3 HEATING/COOLING MODE

- A. Heating Mode:
  1. Heating mode is automatically enabled when outside air temperature drops below setpoint (60°F, adjustable) or when there is a call for heating from the low-temperature alarm in any space. Heating mode is automatically disabled when the outside air temperature rises above setpoint.
  2. Heating control valves are powered from dedicated circuits. When the hot water pumps are disabled, control power to the valves is de-energized, allowing the valves to go to failsafe position. This is to prolong actuator life by turning them off in warm weather.
- B. Cooling mode is enabled by the DDC system when there is a call for mechanical cooling. Economizer cooling is the first stage of cooling. Mechanical cooling is locked out when outside air temperature is below 45°F (adjustable).
- C. Provide manual override points on the graphics screen to allow the Owner to override the automatic heating and cooling modes.

#### 4.4 ENERGY RECOVERY UNIT (ERV-1)

- A. The unit is DDC controlled using electric actuation.
- B. Occupied Mode:
  1. During occupied mode, the outside air damper shall open and the damper end switch shall enable the supply fan to start. The supply fan shall run continuously. During unoccupied mode, the outside air damper shall close and the supply fan shall be off.
- C. Safeties
  1. Current switches are installed at the supply fan. The DDC system uses the switches to confirm the fan is in the desired state (i.e. on or off) and generates an environmental alarm if status deviates from DDC start/stop control.

#### 4.5 ROOFTOP AIR CONDITIONING UNIT (AC-1):

- A. The unit is DDC controlled using electric actuation.
- B. Occupied Mode:
  1. The unit has a DX cooling coil.
  2. During occupied mode, the supply fan shall run continuously. During unoccupied mode, the supply fan shall be off.
- C. Cooling:
  1. Economizer and mechanical cooling is enabled through the DDC system. Refer to Section 237413 for additional information.
- D. Safeties
  - a. Current switches are installed at the supply fan. The DDC system uses the switches to confirm the fan is in the desired state (i.e. on or off) and generates an environmental alarm if status deviates from DDC start/stop control.

#### 4.6 AIR HANDLER AND ERU OPERATOR STATION DISPLAY:

- A. At a minimum, indicate the following on operator workstation display terminal:
  - 1. Supply fan status
  - 2. Supply fan air flow
  - 3. 2 position outdoor air damper status
  - 4. Outdoor and supply air temperature
  - 5. Supply air set point temperature
  - 6. Mechanical cooling status
  - 7. Occupied override status

#### 4.7 FIRE ALARM SYSTEM SHUT-DOWN INTERFACE

- A. For starters that are associated with equipment that is required to be shut down upon a fire alarm condition, provide input contacts within the starter enclosure to interface with the building(s) fire alarm system. Upon receipt of a signal from the building(s) fire alarm system, power to load side of the starter is turned off. Circuitry is provided to ensure that power is off whether the starter is in the “AUTO”, “HAND” or “BYPASS” mode. If this feature is not available from the starter manufacturer, provide a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements of Division 26.

#### 4.8 RE-START PHASING AFTER POWER INTERRUPTION

- A. Upon a power interruption, a loss of power, or at morning start-up, equipment of electrical power greater than or equal to 1.0 HP is started in a staged manner which allows a time delay of 30 seconds between the start of each device.

#### 4.9 ZONE DAMPER ACTUATOR ASSEMBLIES FOR: OFFICE #1, OFFICE #2, OFFICE #3, CONFERENCE ROOM

- A. Building automation system shall provide maximum/minimum airflow control for each respective space based upon space temperature.

#### 4.10 MAIN HEATING COIL (HC-1)

- A. Three-way control valve shall modulate to maintain 70 deg. F discharge air temperature. Control valve shall modulate to full bypass anytime either economizer or mechanical cooling is enabled.

#### 4.11 HOT WATER PUMPS

- A. Pumps P-1 and P-2 shall be interlocked to operate anytime that the respective boiler is enabled.
- B. Differential pressure sensor in the distribution piping monitors pump operation and generates an alarm if differential pressure falls below minimum set point, with time delay on start-up.
- C. When the heating system is enabled the pumps are commanded on. When the heating system is disabled the heating pumps are commanded off.
- D. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:



1. Pump status
2. Pump command
3. Pump run time in hours
4. Differential pressure
5. Differential pressure set point

#### 4.12 HEATING BOILER (B-1)

- A. The boiler is enabled by the Building Automation System (BAS). Connect the boiler controller into the main ATC system for monitoring. Coordinate with Boiler Controller Manufacturer. BAS shall disable boiler during the summer.
- B. The boiler shall maintain a set point temperature of 140 deg F (adj.). If the supply water reset schedule calls for warmer water, the boiler set point temperature increases to 150 deg F.
- C. Provide the following points under this Section. Coordinate with boiler manufacturer.
  1. Boiler set point temperature
  2. Hot water supply header temperature
  3. Hot water return water temperature
  4. Outside air temperature
  5. Burner command status (on/off)
  6. Burner status (on/off /alarm)
  7. Lag boiler status

END OF SECTION 230900

## SECTION 232113 – HYDRONIC PIPING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Pipe and Pipe Fittings For:
  - 1. Heating water piping system.
- B. Valves:
  - 1. Gate valves.
  - 2. Globe or angle valves.
  - 3. Ball valves.
  - 4. Plug valves.
  - 5. Check valves.

#### 1.2 RELATED SECTIONS

- A. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”
- B. Division 23 Section “Identification for HVAC Piping and Equipment.”
- C. Division 23 Section “HVAC Piping Insulation.”
- D. Division 23 Section “Hydronic Specialties.”
- E. Division 23 Section “HVAC Water Treatment”:

#### 1.3 REFERENCES

- A. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
- B. ASME B16.3 - Malleable Iron Threaded Fittings Class 50 and 300.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
- E. ASME B31.5 - Refrigeration Piping.
- F. ASME B31.9 - Building Services Piping.
- G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
- H. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
- I. ASTM B32 - Solder Metal.

- J. ASTM B88 - Seamless Copper Water Tube.
- K. ASTM D1785 - Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
- L. ASTM D2235 - Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
- M. ASTM D2241 - Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR-Series).
- N. ASTM D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.
- O. ASTM D2466 - Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
- P. ASTM D2467 - Socket-Type Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
- Q. ASTM D2680 - Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite-Sewer Piping.
- R. ASTM D2683 - Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
- S. ASTM D2751 - Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
- T. ASTM D2855 - Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
- U. ASTM D3309 - Polybutylene (PB) Plastic Hot-and Cold-Water Distribution Systems.
- V. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- W. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
- X. ASTM F2389 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
- Y. ASTM F845 - Plastic Insert Fittings for Polybutylene (PB) Tubing.
- Z. ASTM F876 - Crosslinked Polyethylene (PEX) Tubing.
- AA. ASTM F877 - Crosslinked Polyethylene (PEX) Plastic Hot - and Cold - Water Distribution Systems.
- BB. AWS A5.8 - Brazing Filler Metal.
- CC. AWS D1.1 - Structural Welding Code.
- DD. AWWA C105 - Polyethylene Encasement for Ductile Iron Piping for Water and Other Liquids.
- EE. AWWA C110 - Ductile - Iron and Grey -Iron Fittings 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.
- FF. AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Grey-Iron Pressure Pipe and Fittings.

GG. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

HH. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures."
- B. Product Data: Include data on pipe materials, pipe fittings, valves, and accessories. Provide Manufacturers catalogue information. Indicate valve data and ratings.
- C. Welders Certificate: Include welder's certification of compliance with ASME SEC 9 and AWS D1.1.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Closeout Procedures."
- B. Record actual locations of valves.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01 Section "Operation and Maintenance Data."
- B. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years experience.
- C. Welders: Certify in accordance with ASME SEC 9. and AWS D1.1.

#### 1.8 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 code for installation of piping system.
- B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.
- C. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## PART 2 - PRODUCTS

### 2.1 HEATING WATER PIPING, ABOVE GROUND

- A. Steel Pipe: ASTM A53, Schedule 40 for sizes less than 12 inch (300 mm), 0.375 inch (10 mm) wall for sizes 12 inch (300 mm) and over, black.
  - 1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type fittings.
  - 2. Joints: Schedule 40 threaded for pipe sizes 2" (50.8 mm) and smaller, and AWS D1.1, welded for pipe sizes 2 1/2" (63.5 mm) and larger.
  - 3. Grooved and Shouldered Pipe End Couplings: As specified in this Section, with grooved steel pipe, is an acceptable alternate to the above for water service operating at temperatures from -30°F to +230°F, utilizing grade E, EPDM gasket compound.
- B. Copper Tubing: ASTM B88, Type L hard drawn.
  - 1. Allowed only for pipe sizes 2" (50.8 mm) and smaller.
  - 2. Fittings: ASME B16.18, cast brass, or ASME B16.22, solder wrought copper.
  - 3. Joints: Solder or braze.

### 2.2 SOLDER MATERIALS:

- A. Manufacturers:
  - 1. Harris (Product: Stay-Brite).
  - 2. Lucas-Milhaupt (Product: Clean 'n Brite).
  - 3. Wolverine (Product: Silvabrite).
  - 4. No substitutions.
- B. Nominal Composition: Alloy of silver and tin (3-6% Ag, remainder Sn). Antimony-free.
- C. Physical Properties:
  - 1. Color: Bright Silver
  - 2. Solidus: 430°F (221°C)
  - 3. Liquidus: 430°F (221°C)
  - 4. Electrical Conductivity: 16.4% IACS
  - 5. Shear Strength: 10,600 psi (73 MPa)
  - 6. Tensile Strength: 14,000 psi (96 MPa)
  - 7. Elongation: 48%

- D. Specification Compliance:
  1. NSF 51
  2. ASTM B32-89, Alloy Grade Sn96
  3. Federal Spec. QQ-S-571E, Class Sn 96 with exception to QPL paragraph 3.1
  4. J-STD-006, Sn96Ag04A
- E. Flux:
  1. Harris (Product: Stay Clean Paste Flux, Stay Clean Liquid Flux (used with 4" or larger copper tubing also stainless steels), or Bridgit Water Soluble Paste Flux).
  2. Canfield (Product: Aqua-Brite or AB Cream Flux). Glycerin-based, water soluble.

### 2.3 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 Inches (50 mm) and Under:
  1. Ferrous Piping: 150 psig (1034 kPa) malleable iron, threaded.
  2. Copper Pipe: Bronze, soldered joints.
  3. Polypropylene Pipe:
    - a. Manufacturer: Aquatherm, Greenpipe product line, no substitutions.
    - b. Polypropylene with polypropylene nut or brass nut.
- B. Flanges for Pipe Over 2 Inches (50 mm):
  1. Ferrous Piping: 150 psig (1034 kPa) forged steel, slip-on.
  2. Copper Piping: Bronze.
  3. Polypropylene Pipe:
    - a. Manufacturer: Aquatherm, Greenpipe product line, no substitutions.
  4. Gaskets: 1/16 inch (1.6 mm) thick preformed neoprene or EPDM, reinforced as required for the system operating pressure, up to relief valve setting.
- C. Grooved and Shouldered Pipe End Couplings:
  1. Approved Manufacturers:
    - a. Victaulic Company.
    - b. Grinnell Mechanical Products (division of Tyco Fire Suppression & Building Products Co.).
    - c. No Substitutions.
  2. Products:
    - a. Housing Clamps: Malleable iron to engage and lock, designed to permit some angular deflection, contraction, and expansion.
    - b. Sealing Gasket: C-shape EPDM elastomer composition for operating temperature range from -30°F (-34°C) to 230°F (110°C). This is the standard gasket material suitable for water and glycol service. For other services, verify material.
    - c. Accessories: Steel bolts, nuts, and washers with zinc plating.
  3. Note: Grooved couplings are not allowed where concealed above hard ceilings.
- D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

### 2.4 VALVES

- A. Manufacturers:
  1. Nibco.

2. Apollo.
  3. Victaulic Company.
  4. Watts.
  5. Wheatley.
  6. No substitutions.
- B. Gate Valves Over 2 Inches (50 mm):
1. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends.
  2. 125 lb S.W.P., 200 lb W.O.G.
- C. Globe or Angle Valves:
1. Up To and Including 2 Inches (50 mm):
    - a. Bronze body, bronze trim, screwed or union bonnet, rising stem and handwheel, inside screw, renewable composition disc and bronze seat, solder or threaded ends.
    - b. 150 lb S.W.P., 300 lb W.O.G.
  2. Over 2 Inches (50 mm):
    - a. Iron body, bronze trim, bolted bonnet, rising stem, handwheel, outside screw and yoke, rotating plug-type disc with renewable seat ring and disc, flanged ends.
    - b. 125 lb S.W.P., 200 lb W.O.G.
- D. Ball Valves:
1. Up To and Including 2 Inches (50 mm):
    - a. Bronze two piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle, solder or threaded ends.
    - b. 150 lb S.W.P., 600 lb W.O.G.
  2. Over 2 Inches (50 mm):
    - a. Cast steel body, chrome plated steel ball, teflon seat and stuffing box seals, lever handle, flanged.
    - b. 150 lb S.W.P., 285 lb W.O.G.
- E. Plug Valves:
1. Up To and Including 2 Inches (50 mm):
    - a. Bronze body, bronze tapered plug, 70 percent port opening, non-lubricated, teflon packing, threaded ends.
    - b. Operator: One plug valve wrench for every ten plug valves minimum of one.
  2. Over 2 Inches (50 mm):
    - a. Cast iron body and plug, 70 percent port opening, pressure lubricated, teflon packing, flanged ends.
    - b. Operator: Each plug valve with a wrench with set screw.
- F. Swing Check Valves:
1. Up To and Including 2 Inches (50 mm): Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.
  2. Over 2 Inches (50 mm): Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.
- G. Spring Loaded Check Valves: Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

## 2.5 SLEEVES

- A. Pipes Through Floors: Form with 16 gage galvanized steel.
- B. Pipes Through Beams, Interior Walls, Fireproofing, Potentially Wet Floor: Form with steel pipe or 16 gage galvanized steel unless indicated otherwise on Drawings.
- C. Pipes Through Exterior Building Walls, Concrete Walls or Footing: Form with Schedule 40 (galvanized) steel pipe.
- D. Size large enough to allow for movement due to expansion and to provide for continuous insulation.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Ream pipe and tube ends. Remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems. Refer to Division 23 Section "HVAC Water Treatment."

### 3.2 INSTALLATION

- A. Install in accordance with Manufacturer's instructions.
- B. Install heating water, glycol, condenser water, and engine exhaust piping to ASME B31.9. Install chilled water piping to ASME B31.5.
- C. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- D. Install piping to conserve building space, and not interfere with use of space.
- E. Group piping whenever practical at common elevations.
- F. Sleeve pipe passing through partitions, walls and floors:
  - 1. Set sleeves in position in advance of concrete work. Provide suitable reinforcing around sleeves.
  - 2. Extend sleeves through 2" (50.8 mm) above finished floor level. Caulk sleeves full depth and provide floor plate.
  - 3. Where piping passes through floor, ceiling or wall, close off space between pipe sleeve and construction with non-combustible insulation or with approved firestopping material when penetrating fire rated floors, ceilings or walls. Provide tight fitting metal



- escutcheons on both ends of sleeves to prevent movement of sleeve during piping expansion. Escutcheons shall be sized slightly larger than outside diameter of piping and smaller than diameter of sleeve. Escutcheons shall be rigidly secured to walls.
4. Where piping passes through fire rated floors, ceilings or walls, close off space between pipe insulation and sleeve with approved firestopping material
  5. Install chrome-plated escutcheons where piping passes through finished surfaces.
- G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- H. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Division 23 Section "HVAC Piping Insulation."
- I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.
- J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- K. Install valves with stems upright or horizontal, not inverted.
- L. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- M. Grooved Mechanical Couplings:
1. Use grooved mechanical couplings and fasteners only in accessible locations. Grooved mechanical couplings are not allowed in areas such as behind sheetrock walls and above sheetrock ceilings.
  2. Install in strict accordance with manufacturer's instructions. Nothing in this Specification is intended to supersede manufacturer's instructions and recommendations.
  3. Prepare pipe ends properly, and check again before coupling installation.
  4. Lubricate gaskets as recommended. Check gasket before installation.
  5. Do not lubricate coupling mating surfaces (bolt pads) or bolt threads, because this might affect torque readings.
  6. Verify that pipe-end separation (all couplings) and deflection from centerline (flexible couplings only) do not exceed manufacturer's specifications. For piping which will operate at a colder temperature than installation temperature (e.g. chilled water systems), butt pipes together to provide maximum contraction capability. For piping which will operate at a warmer temperature (e.g. heating systems), separate pipe ends the maximum allowed amount to provide maximum expansion capability. Some systems operate at mixed temperatures (e.g. cooling tower condenser water systems) and may require different spacing for different sections of the system, and/or a spacing somewhere between minimum and maximum in proportion to the need for expansion and contraction.
  7. NOTE: Tighten nuts evenly by alternating sides until tightened to recommended torque. Make sure the housings' keys completely engage the grooves. Make sure the offsets are equal at the bolt pads, during tightening and when fully tightened. NOTE: It is important to tighten nuts evenly to prevent gasket pinching.
    - a. Victaulic Couplings: On rigid couplings with angled bolt pads, pads will be offset

- when tightened. On flexible couplings, bolt pads will be in contact and aligned when tightened.
- b. Grinnell Couplings: On rigid couplings, bolt pads will have up to 1/16-inch (1.59 mm) gap when tightened. On flexible couplings, bolt pads will be in contact when tightened.
  8. If an impact wrench or other power tool is used to tighten, use extra care.
  9. For couplings with manufacturer torque specifications, verify torque on each bolt. Do not exceed torque specification by more than 25%.
- N. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- O. Use non-conducting dielectric connections whenever jointing dissimilar metals.
- P. Valve Type Selection:
1. Use gate or ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.
  2. Use globe or ball valves for throttling, bypass, or manual flow control services.
  3. Use N.R.S. Gate Valves for general shut-off service in heating system piping 2-1/2" (63.5 mm) and larger.
  4. Use Plug Valves for general throttling applications where indicated.
  5. Use Bronze Globe Valves in throttling applications at control valve bypasses and in expansion tank connection.
  6. Use Bronze Ball Valves for general shut-off service in heating system piping 2" (50.8 mm) and smaller and at heating terminal units 2" (50.8 mm) and smaller, including fin-tube radiation, classroom unit ventilators, convectors and air handling units.
  7. Use Combination Balancing, Flow Measuring and Tight Shut-off Valves at terminal heating and cooling units, zone branches and as indicated.
  8. Use Bronze Ball Valves for drain valves with hose connections. Provide valve of size indicated; if size isn't indicated, provide at least 3/4" (19 mm) valve size. Provide outlet fitting for standard "garden hose" with 3/4" (19 mm) hose threads. Provide brass cap with retainer chain. Compression-type Aboiler drain valves@ are not allowed.
- Q. With the exception of valves which must be properly sized to ensure design flow rates (such as balancing valves), valves shall be line sized.
- R. For valves located more than 7 feet (2.1 m) above finished floor in equipment room areas, provide chain operated sheaves. Extend chains to 5 feet (1.5 m) above finished floor and hook to clips arranged to clear walking aisles.
- S. Install concealed pipes close to building structure to keep furring to a minimum.
- T. Slope water piping 1 inch in 40 feet (1:480) and arrange to drain at low points. Slope piping up in direction of water flow.
- U. On closed systems, equip low points with 3/4" (19 mm) drain valves and hose nipples. Provide, at high points of mains, collecting chambers and high capacity float operated automatic air vents. Provide, at high points of branches, manual air vents with air chambers.
- V. Use main sized saddle type branch connections for directly connecting branch lines to mains in

steel piping if main is at least one pipe size larger than the branch for up to 6" (152 mm) mains and if main is at least two pipe sizes larger than branch for 8" (203 mm) and larger mains. Do not project branch pipes inside the main pipe.

- W. Make connections to equipment and branch mains with unions.
- X. Pipe used shall be new material, and threads on piping shall be full length and clean cut with inside edges reamed smooth to full inside bore.
- Y. Caulking of threads will not be allowed on any piping.
- Z. Pipe joint compound shall be put on male threads only.
- AA. In the erection of mains, special care must be used in the support, working into place without springing or forcing, and proper allowance made for expansion.
- BB. Pipes shall be anchored, guided, and otherwise supported, where necessary, to prevent vibration or to control expansion.
- CC. Make such offsets as are shown and required to place the pipes and risers in proper position to avoid other work.
- DD. Install a sufficient number of unions or flanged fittings to facilitate making possible future alterations or repairs.
- EE. Erect piping to provide for the easy passage and noiseless circulation of water under working conditions.
- FF. Where welded joints are required, steel piping shall be installed by the use of the oxyacetylene or electric welding process, except immediate connections to accessible equipment may be threaded. Piping shall have butt welds with welding fittings, standard factory fabricated tees, elbows, reducers, caps, and accessories. Branch outlets 2" (50.8 mm) and smaller shall be made by the use of approved welding type 1/2 couplings, "Weldolet" or "Threadolet" fittings.
  - 1. Piping smaller than 2" (50.8 mm) may be installed at the Contractor's option with welding type, or threaded type fittings, except that piping regardless of size concealed in trenches or inaccessible building construction (e.g. concealed behind sheetrock walls or concealed above sheetrock ceilings) shall be welded.
  - 2. Offsets shall be installed with long radius welding elbows.
  - 3. Welding shall be executed only by certified welding mechanics in accordance with the best practice of the trade.
- GG. Take branch lines off bottom of mains or at 45 degree bottom angle, as space permits.
- HH. Minimum pipe size allowed for heating water, chilled water, steam and condensate piping shall be 3/4" (19 mm). Piping less than 3/4" (19 mm) shall not be allowed for these piping systems.
- II. For isolation valves, control valves and balancing valves located above suspended ceilings and in areas that are not visible to building occupants (for example, mechanical rooms), provide yellow colored surveyors tape. Permanently attach tape to valve handles and run tape down to 10 inches (254 mm) above ceiling or 12 inches (305 mm) below valve handle where ceilings do not exist (for example, mechanical rooms).

- JJ. Standard details for heating coils are based on single coil arrangements. For heating and cooling coils that are supplied in a split coil arrangement, with two or more individual coils, provide additional piping and balancing valves at each coil to ensure that flow through each coil is proportional to the percentage of total coil face area that the coil occupies.

### 3.3 CLEANING

- A. After satisfactory completion of pressure tests, before permanently connecting equipment, strainers, and the like, clean equipment thoroughly, blow and flush piping for a sufficient length of time as directed, so that interiors will be free of foreign matter. Perform cleaning in the presence of an authorized representative of the Architect. Provide a minimum of 10 days notification to the Architect prior to system cleaning.
- B. Fill, vent and circulate the system with approved solution in accordance with equipment (boiler, piping, coils, and others) manufacturer's recommendation, allowing it to reach design or operating temperatures. After circulating for 6 (six) hours, drain the system completely and remove and clean strainer screens. Perform cleaning in the presence of an authorized representative of the Architect. Provide a minimum of 10 days notification to the Architect prior to system cleaning.
- C. Fill and vent system as required.
- D. Manually vent heat transfer units and high points of the system.
- E. Adjust the pressure reducing valve to provide minimum of 5 psig (35 kPa) pressure at the highest point of the system.
- F. After system has been completely filled, start zone pumps and circulate cold water for a short time to dislodge small air bubbles, and return them to air extraction device.
- G. Raise water temperature to 200°F (93°C) while operating pumps.
- H. Stop pump and vent radiation and high points of the system. Normal operation may now be started at any time.

### 3.4 TESTING

- A. No joint or section of piping shall be left untested.
- B. Before testing piping systems, remove, or otherwise protect from damage, control devices, air vents, and other parts which are not designed to stand test pressures.
- C. Test piping for leaks under 100 psig air pressure with soap suds prior to hydrostatic testing.
- D. Test piping hydrostatically to one and one-half times the maximum systems operating pressure, but in no case to less than 75 psig, for at least 4 consecutive hours, during which time pressure shall remain constant without pumping.
- E. Test and obtain Architect's approval before painting, covering, or concealing piping, including swing joints.

### 3.5 SCHEDULES

#### A. Pipe Hanger Spacing:

PIPE SIZE		HANGER ROD MAX. HANGER SPACING		HANGER ROD DIAMETER	
Inches	(mm)	Feet	(m)	Inches	(m)
Steel and Copper Piping					
1/2 to 1- 1/4	12 to 32	6.5	2	3/8	9
1-1/2 to 2	38 to 50	10	3	3/8	9
2-1/2 to 3	62 to 75	10	3	1/2	13
4 to 6	100 to 150	10	3	5/8	15

END OF SECTION 232113

## SECTION 232118 – HYDRONIC SPECIALTIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Expansion tanks.
- B. Air vents.
- C. Air separators.
- D. Strainers.
- E. Combination fittings.
- F. Combination Valve Assemblies.
- G. Relief valves.
- H. Glycol specialties.

#### 1.2 RELATED SECTIONS

- A. Division 23 Section “Meters and Gauges for HVAC Piping.”
- B. Division 23 Section “Hydronic Piping.”
- C. Division 23 Section “HVAC Water Treatment”

#### 1.3 REFERENCES

- A. ASME - Boilers and Pressure Vessel Codes, SEC 8-D-Rules for Construction of Pressure Vessels.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01 Section “Submittal Procedures.”
- B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description, model and dimensions.
- C. Submit inspection certificates for pressure vessels from authority having jurisdiction.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

## 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Closeout Procedures."

## 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01 Section "Operation and Maintenance Data."
- B. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

## 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01 Section "Product Requirements."
- B. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- C. Provide temporary protective coating on cast iron and steel valves.
- D. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- E. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

## 1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of glycol system for one year from date of substantial completion.
- B. Monthly visit to make glycol fluid concentration analysis on site with refractive index measurement instrument. Detail findings with maintenance personnel in writing of corrective actions needed including analysis and amounts of glycol or water added.

## PART 2 - PRODUCTS

### 2.1 DIAPHRAGM-TYPE EXPANSION TANKS

- A. Manufacturers:
  - 1. Taco.
  - 2. Bell & Gossett.
  - 3. John Wood.
  - 4. Wessels.
  - 5. Wheatley.

- B. Construction: Welded steel, tested and stamped in accordance with ASME SEC 8-D; supplied with National Board Form U-1, rated for working pressure of 125 psig (860 kPa), with flexible butyl or EPDM diaphragm sealed into tank, and steel support stand.
- C. Accessories: Pressure gauge and air-charging fitting, tank drain.

## 2.2 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch (50 mm) diameter pipe to form air chamber, with 1/8 inch (3 mm) brass needle valve at top of chamber.
- B. Float Type:
  - 1. Manufacturers:
    - a. Bell & Gossett.
    - b. Caleffi.
    - c. Taco.
    - d. Thrush.
    - e. Wheatley.
  - 2. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
- C. Washer Type:
  - 1. Manufacturers:
    - a. Bell & Gossett.
    - b. Caleffi.
    - c. Taco.
  - 2. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

## 2.3 AIR SEPARATORS

- A. In-Line Air Scoops:
  - 1. Manufacturers:
    - a. Taco.
    - b. Bell & Gossett.
    - c. Thrush.
    - d. Wheatley.
  - 2. Cast iron in sizes 1 inch (25 mm) to 3 inch (76 mm), for 125 psig (860 kPa) operating pressure. Internal baffle to promote air separation. Top fittings for air vent and expansion tank, bottom fitting for expansion tank. Enamel paint finish.

## 2.4 STRAINERS

- A. Manufacturers:
  - 1. Sarco.
  - 2. Armstrong.
  - 3. Barnes and Jones.
  - 4. Bell & Gossett.
  - 5. Muesco.
  - 6. Wheatley.



- B. Size 2 inch (50 mm) and Under: Screwed brass or iron body for 175 psig (1200 kPa) working pressure, Y pattern with 1/32 inch (0.8 mm) stainless steel perforated screen.
- C. Size 2-1/2 inch (65 mm) to 4 inch (100 mm): Flanged iron body for 175 psig (1200 kPa) working pressure, Y pattern with 3/64 inch (1.2 mm) stainless steel perforated screen.
- D. Size 5 inch (125 mm) and Larger: Flanged iron body for 175 psig (1200 kPa) working pressure, basket pattern with 1/8 inch (3.2 mm) stainless steel perforated screen.

## 2.5 BALANCING VALVES AND COMBINATION BALANCING/SHUT-OFF VALVES.

- A. Manufacturers:
  - 1. Bell & Gossett.
  - 2. Armstrong.
  - 3. Flow Design, Inc.
  - 4. Gerand.
  - 5. Griswold Controls.
  - 6. Mepco.
  - 7. Nexus Valve.
  - 8. Taco.
  - 9. Tour and Andersson.
  - 10. Watts.
  - 11. Wheatley.
- B. Valves shall conform to one of the following:
  - 1. Fixed-Orifice Manual Balancing Valve: Calibrated, ball type balance valve with precision machined orifice, readout valves equipped with integral check valves and gasketed caps, calibrated nameplate and indicating pointer with memory stop. Readout valves measure the pressure differential across the fixed orifice plate or venturi. Valve shall be designed for positive shut-off.
- C. Size balancing valves to allow a reading of 2 to 5 ft wg (6 to 15 kPa) pressure drop at design flow rates. Submittals shall include a chart of valve selections, indicating room number, terminal heating device tag, flow rate, pressure drop, and differential pressure reading.
- D. Insulation: Valves may be furnished with prefabricated thermal insulation. Flame spread reading shall be 25 or less per ASTM E84. R-value shall be 4 hr-sq.ft- F/Btu or greater. Install in accordance with Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."

## 2.6 COMBINATION VALVE ASSEMBLIES

- A. Manufacturers:
  - 1. Flow Design, Inc.
  - 2. Griswold Controls.
  - 3. Nexus Valve.

- B. Assemblies combining valves and accessories may be furnished in lieu of the individual components, provided that the components are in the arrangement indicated on the Drawings and conform to the individual Specifications. Examples include combinations of manual balancing valves, unions, pressure/temperature test ports, strainers, manual air vents, flexible hose connections, and shutoff valves.

## 2.7 AUTOMATIC COLD WATER FILL ASSEMBLY

- A. Manufacturers:
  - 1. Taco.
  - 2. Bell & Gossett.
  - 3. Caleffi.
  - 4. Spence.
  - 5. Watts.
  - 6. Wheatley.
- B. Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.
- C. Set pressure reducing valve to achieve 5 psi gauge pressure at high point of system. Provide pressure gauge at high point of system[, per Section 15135/230519]. Set pressure reducing valve when the temperature of the water in the system is less than 80 degrees F.

## 2.8 RELIEF VALVES

- A. Manufacturers:
  - 1. Bell & Gossett.
  - 2. Cash Acme.
  - 3. Spence.
  - 4. Taco.
  - 5. Watts.
  - 6. Wheatley.
- B. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labeled.
- C. Factory set to relieve pressure at 40 psi.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- C. Provide manual air vents at system high points and as indicated.
- D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

- E. Provide air separator on suction side of system circulation pump and connect to expansion tank.
- F. Provide valved drain and hose connection on strainer blow down connection.
- G. Provide balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.
- H. Ensure that balancing valves are installed with minimum upstream length of straight pipe as recommended by the manufacturer.
- I. Ensure that balancing valves are installed with the readout valves fully accessible, including space required for insertion of metering probes.
- J. Provide relief valves on pressure tanks, low pressure side of reducing valves, heat exchangers, and expansion tanks.
- K. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to not exceed maximum pressure rating of connected equipment.
- L. Pipe relief valve outlet to nearest floor drain.
- M. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.
- N. Standard details for heating coils are based on single coil arrangements. For heating coils that are supplied in a split coil arrangement, with two or more individual coils, provide additional piping and balancing valves at each coil to ensure that flow through each coil is proportional to the percentage of total coil face area that the coil occupies.
- O. Install combination valve assemblies to account for small offsets between coils connections and hard pipe connections. Assemblies shall not be installed in a manner that forms bends of more than 90 degrees total.

END OF SECTION 232118

## SECTION 232123 – HYDRONIC PUMPS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Cartridge circulators.

#### 1.2 RELATED SECTIONS

- A. Division 23 Section “Motors, Drives and Accessories.”
- B. Division 23 Section “HVAC Piping Insulation.”
- C. Division 23 Section “Hydronic Piping.”
- D. Division 23 Section “Hydronic Specialties”

#### 1.3 REFERENCES

- A. UL 778 - Motor Operated Water Pumps.
- B. NFPA 70 - National Electrical Code.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading throughout the entire operating range in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01 Section “Submittal Procedures.”
- B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.
- D. Millwright's Certificate: Certify that base mounted pumps have been aligned.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01.
- B. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacture, assembly, and field performance of pumps with minimum three years experience.
- B. Alignment: Base mounted pumps shall be aligned by qualified millwright.

## 1.8 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Taco.
- B. Bell & Gossett.
- C. Grundfos.
- D. Armstrong.
- E. Substitutions: Under provisions of Division 01 Section "Product Requirements."

### 2.2 GENERAL

- A. Statically and dynamically balance rotating parts.
- B. Construction to permit complete servicing without breaking piping or motor connections.
- C. Pumps to operate at 1750 rpm unless specified otherwise.
- D. Pump connections to be flanged.
- E. Wetted parts shall be compatible with circulated fluid.

### 2.3 CARTRIDGE CIRCULATORS

- A. Type: Cartridge type circulator, in-line mounting, for 125 psig (862 kPa) maximum working pressure, 230°F (110°C) maximum water temperature.
- B. Casing: Cast iron with flanged pump connections.
- C. Impeller: Non-Metallic
- D. Shaft: Ceramic
- E. Bearings: Carbon.
- F. Motor: Impedance protected, three speed, permanent split capacitor.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify that electric power is available and of the correct characteristics.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches (102 mm) and over. Refer to Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment".
- D. Provide line sized shut-off valve and strainer on pump suction, and properly sized soft seat check valve and balancing valve on pump discharge.
- E. Lubricate pumps before start-up.
- F. The pumps shall be installed with start-up strainers, inlet and outlet gate valves, discharge spring-loaded check and balance/flow-measuring valves and pressure gauges on suction and discharge.
- G. Provide necessary brackets or hanger supports as required to relieve the stress on the pumps and piping.
- H. Provide labor and materials required to ensure that pump impellers are adequately sized to provide flow rates as indicated. This shall include, but not be limited to, trimming impellers.

END OF SECTION 232123

## SECTION 232500 – HVAC WATER TREATMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Cleaning of piping systems.

#### 1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

- A. Division 23 Section “Hydronic Piping”

#### 1.3 RELATED SECTIONS

- A. Division 23 Section “Instrumentation and Controls For HVAC.”

#### 1.4 REFERENCES

- A. NFPA 70 - National Electrical Code.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01 Section “Submittal Procedures.”
- B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.
- C. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.
- D. Submit certificate of compliance from authority having jurisdiction indicating approval of chemicals and their proposed disposal.

#### 1.6 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”
- B. Operation and Maintenance Data: Include data on chemical feed pumps, agitators, and other equipment including spare parts lists, procedures, and treatment programs. Include step by step instructions on test procedures including target concentrations.

#### 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum three years experience. Company shall have local representatives with water analysis laboratories and full time service personnel.
- B. Installer: Company specializing in performing the work of this section with minimum three years experience and approved by manufacturer.

## 1.8 REGULATORY REQUIREMENTS

- A. Conform to applicable code for addition of non-potable chemicals to building mechanical systems, and for to public sewage systems.
- B. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

## 1.9 MAINTENANCE SERVICE

- A. Furnish service and maintenance of treatment systems for one year from Date of Substantial Completion.
- B. Provide monthly technical service visits to perform field inspections and make water analysis on site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.
- C. Provide laboratory and technical assistance services during this maintenance period.
- D. Include two hour training course for operating personnel, instructing them on installation, care, maintenance, testing, and operation of water treatment systems. Arrange course at start up of systems.
- E. Provide on site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

## 1.10 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 01 Section "Product Requirements."
- B. Provide sufficient chemicals for treatment and testing during warranty period.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Barclay Water Management.
- B. Diversy Water Technologies, Inc.
- C. Substitutions: Under provisions of Division 01 – Product requirements.

### 2.2 MATERIALS

- A. System Cleaner:
  - 1. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodium tripoly phosphate and sodium molybdate.
  - 2. Biocide; chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or



microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
- B. Place terminal control valves in open position during cleaning.
- C. Verify that electric power is available and of the correct characteristics.

#### 3.2 CLEANING SEQUENCE

- A. Concentration:
  - 1. As recommended by manufacturer.
  - 2. One pound per 100 gallons (1 kg per 1000 L) of water contained in the system.
  - 3. One pound per 100 gallons (1 kg per 1000 L) of water for hot systems and one pound per 50 gallons (1 kg per 500 L) of water for cold systems.
- B. Hot Water Heating Systems:
  - 1. Apply heat while circulating, slowly raising temperature to 160°F (71°C) and maintain for 12 hours minimum.
  - 2. Remove heat and circulate to 100°F (37.8°C) or less; drain systems as quickly as possible and refill with clean water.
  - 3. Circulate for 6 hours at design temperatures, then drain.
  - 4. Refill with clean water and repeat until system cleaner is removed.
- C. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.
- D. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.
- E. Remove, clean, and replace strainer screens.
- F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

#### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

END OF SECTION 232500

## SECTION 233113 – METAL DUCTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Metal Ductwork.
- B. Air Duct Leakage Tests.

#### 1.2 RELATED SECTIONS

- A. Division 01 Section “Testing, Adjusting and Balancing for HVAC.”
- B. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment”: Sleeves
- C. Division 23 Section “Duct Insulation”: External insulation
- D. Division 23 Section “Air Duct Accessories”

#### 1.3 REFERENCES

- A. ASTM A 36 - Structural Steel.
- B. ASTM A 90 - Standard Test Method for Weight of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
- C. ASTM A 167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- D. ASTM A 480 - General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
- E. ASTM A 568 - Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled.
- F. ASTM A 653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- G. ASTM A 1008 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- H. ASTM A 1011 - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
- I. ASTM B 209 - Aluminum and Aluminum-Alloy Sheet and Plate.
- J. ASTM C 14 - Concrete Sewer, Storm Drain, and Culvert Pipe.
- K. ASTM C 443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.

- L. AWS D9.1 - Welding of Sheet Metal.
- M. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment.
- N. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- O. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.
- P. NFPA 91 - Installation of Blower and Exhaust Systems for Dust, Stock and Vapor Removal or Conveying.
- Q. NFPA 96 - Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment.
- R. SMACNA - HVAC Air Duct Leakage Test Manual.
- S. SMACNA - HVAC Duct Construction Standards - Metal and Flexible (SMACNA HVACDCS).
- T. SMACNA - Fibrous Glass Duct Construction Standards.
- U. UL 181 - Factory-Made Air Ducts and Connectors.
- V. UL 1978 - Grease Ducts.
- W. UL 2221 - Tests of Fire Resistive Grease Duct Enclosure Assemblies.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. No variation of duct configuration or sizes permitted except by written permission. Size round ducts installed in place of rectangular ducts in accordance with ASHRAE table of equivalent rectangular and round ducts.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures".
- B. Shop Drawings: Indicate duct fittings, particulars such as gauges, sizes, welds, and configuration. Submit prior to start of work.
- C. Product Data: Provide data for duct materials, duct liner and duct connectors.
- D. Samples:
  1. Submit as indicated on the Drawings, and as specified herein.
  2. Submit sample shop-fabricated mitered (vaned) and radiused elbows.
  3. Submit mock-up installation of a vertical fire damper.
- E. Test Reports: Submit testing apparatus, procedures, and preliminary forms prior to performing tests. On final reports, indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA HVAC Air Duct Leakage Test Manual.

## 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Closeout Procedures."
- B. Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Indicate additional fittings used.

## 1.7 QUALITY ASSURANCE

- A. Perform Work in accordance with SMACNA HVACDCS.

## 1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.
- B. Installer: Company specializing in performing the work of this section with minimum three years experience.

## 1.9 REGULATORY REQUIREMENTS

- A. Construct ductwork to NFPA 90A and NFPA 90B standards.

## 1.10 ENVIRONMENTAL REQUIREMENTS

- A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.
- B. Maintain temperatures during and after installation of duct sealants.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufactured Ductwork - Transverse Duct Connection System:
  - 1. Ductmate.
  - 2. HFC Enterprises; Covina, CA - round and flat oval ducts only.
- B. Sealants:
  - 1. Hardcast, a division of Carlisle Corporation.
  - 2. Ductmate.
  - 3. Mon-Eco Industries, Inc - Eco product line.
  - 4. McGill AirSeal LLC, a subsidiary of United McGill Corporation.
  - 5. Minnesota Mining and Manufacturing (3M).
  - 6. Polymer Adhesive Sealant Systems.

## 2.2 MATERIALS

- A. Galvanized Steel Ducts:
  - 1. Steel sheet metal components of galvanized ductwork in this Specification Section shall be galvanized steel sheet, lock-forming quality, having G60 or heavier zinc coating (G90 minimum for outdoor or moist applications) conforming to ASTM A653 rating system and tested in accordance with ASTM A90.
  - 2. Provide paint-grip exterior surfaces for exposed ducts, where available.
  - 3. Sheet metal gauge shall be not less than 26 gauge (0.56 mm).

## 2.3 ACCESSORIES

- A. Fasteners: Rivets, bolts, or sheet metal screws.
- B. Sealants: See Duct Sealant portion of this Specification.
- C. Hanger Rod: ASTM A36; galvanized steel; threaded both ends, threaded one end, or continuously threaded.

## 2.4 DUCTWORK FABRICATION

- A. Fabricate and support in accordance with SMACNA HVACDCS, as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.
- B. SMACNA Duct Construction Manuals:
  - 1. The SMACNA recommendations shall be considered as mandatory requirements.
  - 2. Substitute the word "shall" for the word "should" in these manuals.
  - 3. Where the Contract Specifications differ from SMACNA recommendations, the more stringent requirements (as determined by the Architect) shall take precedence.
  - 4. Details on the Contract Drawings take precedence over SMACNA standards.
- C. Sheet metal shall be galvanized steel as specified in Part 2 paragraph "Materials" in this Section, unless otherwise indicated or specified.
- D. Construct Tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
  - 1. Where space is too restricted for full-radius elbows, provide mitered (square-throat) elbows with single wall turning vanes. Do not use air foil turning vanes.
  - 2. Mitered elbows in round or flat-oval ductwork shall be factory-manufactured.
  - 3. Radiused elbows with throat radius 1/2 times width of duct (centerline radius 1 width of duct) may be used instead of mitered elbows, but only where space is too restricted for full radius.
  - 4. Fittings not conforming to these requirements will be ordered removed and replaced with proper fittings.
- E. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

- F. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA Standard. Joints shall be minimum 4 inch (100 mm) cemented slip joint, brazed or electric welded. Prime coat welded joints.
- G. Provide standard 45 degree lateral wye takeoffs unless otherwise indicated where 90 degree conical tee connections may be used.
- H. Longitudinal locks or seams known as Abutton-punch-snap-lock@ and other “snap-lock” types will not be permitted in rectangular duct. Snap-lock longitudinal seams may be used on round ducts up to 8 inches diameter, with screws provided to secure the seams at 24 inches on center maximum spacing.
- I. Exposed Ducts: Select and handle materials with care for a neat appearance. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable.

## 2.5 PRESSURE CLASSIFICATION

- A. Ratings as indicated on the Drawings or as specified. See Ductwork Pressure Class Schedule in Part 3 of this Section.
- B. If no ratings are indicated, ductwork shall be rated for the external static pressure of the system plus twenty-five percent.
  1. If 4 dampers (of any type) or fewer can isolate a duct system, that portion of the system shall be rated for the shut-off pressure of the system fans.

## 2.6 DUCT SEALING

- A. Seal ductwork as outlined in the SMACNA HVACDCS. Seal ductwork to a minimum of class A (transverse joints, longitudinal seams, and duct wall penetrations), regardless of pressure class.
- B. Seal ductwork systems as required to ensure that maximum duct leakage does not exceed that allowed by the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual. Allow sealant to dry in accordance with manufacturer=s requirements of time and environmental conditions before ductwork systems are pressurized.
- C. Duct sealing materials used shall be non-flammable and non-combustible in both liquid and solid states.
- D. Seal exposed ducts by applying mastic-type or gasket-type sealer just before the joint or seam is made; remove excess sealant for a neat appearance.
- E. Materials for Sealing:
  1. Hardcast: Flex-Grip 550 or Iron-Grip 601 mastic.
  2. Hardcast: gypsum-based tape and mastic, waterproof type when used on moist-air exhaust or in humid or outdoor locations.
  3. Ductmate: Flanged lateral joints with gaskets.
  4. Ductmate: PROseal.
  5. Mon-Eco: Eco-Duct Seal 4450 (red color) or 4452 (grey color). Use grey color where ducts will be unpainted and exposed to public view.
  6. Polymer Adhesives Sealant Systems: Airseal No. 11 premium sealant.

## 2.7 UNIFORMITY OF MATERIALS

- A. Ductwork accessories shall be fabricated of materials that are similar to the ductwork in which they are installed.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install ducts in accordance with SMACNA HVACDCS.
- C. Duct Sizes are inside clear dimensions.
- D. "Fishmouth" duct connections are not allowed.
- E. Exposed Ducts:
  - 1. Handle with care for a neat appearance. Repair or replace dented or damaged ductwork as required by the Architect. Select hangers for appearance, and to prevent sagging or distortion of duct.
  - 2. Remove labels attached to ducts before receiving paint.
- F. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pitot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.
- G. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
- H. Use crimp joints with or without bead for joining round duct sizes 8 inch (200 mm) and smaller with crimp in direction of air flow.
- I. Use double nuts and lock washers on threaded rod supports. Strap hangers shall be minimum 16-gauge (1.50 mm) x 1-inch (25 mm) galvanized straps. Hanger and support components including but not limited to Aunistrut® shall be galvanized steel except that where other duct materials are used, the hanger materials shall be compatible and non-corrosive to the duct. Wire hangers are not acceptable.
- J. Set plenum doors 6 to 12 inches (150 to 300 mm) above floor. Arrange door swings so that fan static pressure holds door in closed position.
- K. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system. Do not start ducted air moving equipment until construction is completed to a stage where airborne construction dust is no longer present. At the time of substantial completion, the entire air distribution system shall be turned over to the Owner clear of construction dust and debris. If the interior surfaces of any ducted air moving equipment or the interior surfaces of any portion of the ductwork distribution

system are found, as determined by the Architect, to contain significant construction dust and debris, the entire air distribution system shall be cleaned in accordance with **Division 23**. If proper precautions are taken to prevent construction dust and debris from entering the ductwork during construction and if the Architect finds all ductwork to be free from such dust and debris, air duct cleaning shall not be required.

- L. For fresh air intake and exhaust plenums connected to louvers or brick or block vents, pitch bottom of plenums down to bottom of louver at minimum 1/4" per foot (2 percent). Seal connections and joints on bottom of plenums watertight with mastic. Connect bottom of plenum to top-inside edge of bottom louver blade or waterstop as detailed on the Drawings, to ensure positive drainage

### 3.2 AIR DUCT LEAKAGE TESTS

- A. Perform air duct leakage tests in accordance with the testing procedures outlined in the latest edition of the SMACNA HVAC Air Duct Leakage Test Manual.
- B. Leakage testing shall be performed on complete ductwork including fittings and accessories such as dampers, access doors, branch connections, and inlets and outlets. Flexible ducts, air handling units, and duct coils may be excluded. Ducts may be temporarily sectioned and capped for testing, for reasons of limited test apparatus capacity, or requirements of construction phasing.
- C. Leakage tests, including retests as required, shall be performed prior to concealment and insulation.
- D. The Following Duct Systems Shall Be Tested for Leakage, regardless of whether or not SMACNA recommends testing:
  - 1. New ductwork installed at owner furnished air handling units.
- E. Submit testing apparatus, procedures, and preliminary forms prior to performing tests.
- F. Once leakage tests are complete, submit leakage test report. Leakage test report forms shall include the following:
  - 1. Project and system identification data
  - 2. Description of ductwork under test
  - 3. Leakage class specified
  - 4. Test pressure specified
  - 5. Duct construction pressure class
  - 6. Duct design air flow
  - 7. Surface area of ductwork under test
  - 8. Maximum allowable leakage factor
  - 9. Calculated allowable leakage
  - 10. Test apparatus
    - a. Blower
    - b. Orifice, tube size
    - c. Orifice size
    - d. Orifice coefficient
    - e. Calibration date
  - 11. Test orifice differential pressure
  - 12. Leakage for tested section



- 13. Total leakage for system
- 14. Date of test
- 15. Witnesses

- G. Air duct leakage testing shall be performed by an experienced agency that is independent of the Testing, Adjusting and Balancing (TAB) Agency specified in Division 01 - Testing, Adjusting and Balancing.
- H. The TAB Agent shall witness the duct leakage tests performed under Division 23. At a minimum, the first duct leakage test shall be witnessed and approved by the TAB Agent and the Engineer. At a minimum, subsequent duct leakage tests shall be witnessed and approved by the TAB Agent. The TAB Agent shall confirm proper testing procedures and shall give written approval of the leakage tests. If deficiencies are discovered, the TAB agent shall document these deficiencies to the Contractor and the Engineer. Once deficiencies are corrected, the TAB Agent shall witness follow-up leakage tests.
- I. Coordinate with TAB Agency and receive written sign-off of the leakage tests by the TAB Agent prior to submitting leakage test report.
- J. Leakage Class Schedule

DUCT PRESSURE CLASS	DUCT TYPE	LEAKAGE CLASS
1/2", 1", 2" W.G.	Rectangular Metal	12

### 3.3 SCHEDULES

- A. Ductwork Material Schedule

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Galvanized Steel
Return and Relief	Galvanized Steel
General Exhaust	Galvanized Steel
Outside Air Intake	Galvanized Steel

B. Ductwork Pressure Class Schedule

AIR SYSTEM	SMACNA PRESSURE CLASS
Supply (Heating Systems)	1 inch (250 Pa)
Return and Relief	1 inch (250 Pa)
General Exhaust	1 inch (250 Pa)
Outside Air Intake	1 inch (250 Pa)

END OF SECTION 233113

## SECTION 233300 – AIR DUCT ACCESSORIES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Duct Test Holes.
- B. Flexible Duct Connections.
- C. Duct Access Doors.

#### 1.2 RELATED SECTIONS

- A. Division 01 for “Operation and Maintenance Data.”
- B. Division 07 Section “Through-Penetration Firestop Systems.”
- C. Division 23 Section “Identification for HVAC Piping and Equipment.”
- D. Division 23 Section “Vibration and Seismic Controls for HVAC Piping and Equipment.”
- E. Division 23 Section “Metal Ducts.”
- F. Division 26 “Electrical”: Electrical characteristics and wiring connections.

#### 1.3 REFERENCES

- A. ASTM C423-02a - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
- B. ASTM E477-99 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.
- C. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.
- D. NFPA 92A - Smoke Control Systems.
- E. NFPA 70 - National Electrical Code.
- F. SMACNA - HVAC Duct Construction Standards - Metal and Flexible, Third Edition - 2005 (HVACDCS).
- G. SMACNA - Seismic Restraint Manual - Guidelines for Mechanical Systems (SRMGMS).
- H. UL 33 - Heat Responsive Links for Fire-Protection Service.
- I. UL 555 - Fire Dampers and Ceiling Dampers.
- J. UL 555S - Leakage Rated Dampers for Use in Smoke Control Systems.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01 for “Submittal Procedures.”
- B. Shop Drawings: Indicate for shop fabricated assemblies including duct test holes.
- C. Product Data: Provide for shop fabricated assemblies including duct test holes and hardware used.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 for “Closeout Procedures.”
- B. Record actual locations of test holes.

#### 1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the products specified in this section with minimum three years experience.

#### 1.7 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect and handle products to site under provisions of Division 01 for “Product Requirements.”

### PART 2 - PRODUCTS

#### 2.1 GALVANIZED STEEL

- A. Steel sheet metal components of accessories in this Specification Section shall be galvanized steel sheet, lock-forming quality, having G60 or heavier zinc coating conforming to ASTM A653 rating system and tested in accordance with ASTM A90. Provide paint-grip exterior surfaces for exposed ducts, where available.

#### 2.2 DUCT TEST HOLES

- A. Manufacturers:
  - 1. Ductmate.
  - 2. Ventfabrics.
  - 3. Duro-Dyne.
- B. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

- C. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

## 2.3 FLEXIBLE DUCT CONNECTIONS

- A. Manufacturers:
  - 1. Ductmate.
  - 2. Ventfabrics.
  - 3. Duro-Dyne.
- B. Fabricate in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings.
- C. Connector: Fabric crimped into metal edging strip.
  - 1. Connectors shall be Ductmate PROFLEX or approved equal.
  - 2. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd (1.0 kg/sq m).
  - 3. Net Fabric Width: Approximately 6 inches (150 mm) wide.
  - 4. Metal: 3 inch (75 mm) wide, 24 gage (0.6 mm thick) galvanized steel.
  - 5. Connectors shall have double fold seams. Single fold seams (metal folded once only) shall not be accepted.

## 2.4 DUCT ACCESS DOORS

- A. Manufacturers of Standard Doors:
  - 1. Ruskin.
  - 2. Air Balance, Inc.
  - 3. Arrow.
  - 4. Cesco.
  - 5. DuctMate.
  - 6. Greenheck.
  - 7. NCA.
  - 8. Vent Products, Inc.
- B. Fabricated in accordance with SMACNA HVACDCS, and as specified or as indicated on the Drawings. Standard access doors and access doors for grease ducts may be shop-fabricated. Pressure rating shall be equal to the rating of the associated ductwork.
- C. Standard Doors: Removable, with retainer chain. Rigid and close-fitting with sealing gaskets and quick fastening locking devices. For insulated ductwork, install minimum 1 inch (25 mm) thick insulation with galvanized steel sheet metal airstream-side cover.
  - 1. 16 inches (406 mm) Square and Smaller: Secure with two sash locks.
  - 2. Over 16 inches (406 mm), up to 24 inches (610 mm) Square: Provide four sash locks.
  - 3. Larger Sizes: Hinges and two compression latches with outside and inside handles.
  - 4. Clamping-type doors with knob handles, as manufactured by Ductmate, may be substituted for standard sizes.
  - 5. Material: Galvanized steel in galvanized steel ductwork. Stainless steel in stainless steel ductwork. Aluminum as manufactured by Arrow in aluminum ductwork.

6. Provide in negative-pressure systems, and in positive-pressure systems with specified pressure class at or below 2 in. WG (498 Pa).
- D. Access doors with sheet metal screw fasteners are not acceptable.
- E. Sizing: Select sizes to allow testing, service, and maintenance within the ductwork. Such access may require the insertion of one or both hands, arms, and shoulders as appropriate. Doors sized for viewing-only are not acceptable. Doors found to be of inadequate size shall be replaced with proper size.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA HVACDCS. Refer to Division 23 Section "Metal Ducts" for duct construction and pressure class.
- B. Provide duct access doors in horizontal fresh air intake ductwork to facilitate the removal of accumulations of dust and combustible materials in accordance with NFPA 90A.
- C. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and support by vibration isolators. Staple and seal connections airtight.
- D. Duct Hangers and Supports: SMACNA HVACDCS, Section 4. Hang ducts up to and including 36 inches (914 mm) in width by a minimum of 1 in x 16 gage (25 mm x 1.61 mm) flat straps on each side of the duct on 4 ft (1.22 m) centers, bent under bottom of duct a minimum of 2 inches (50 mm) and securely fastened to duct. Hang ducts larger than 36 inches (914 mm) in width by 3/8 inch (9.5 mm) steel rods and 2 x 2 x 1/4-inch (50x50x6.3 mm) steel angle trapeze hangers, spaced 4 ft (1.22 mm) on center. Provide seismic restraint complying with SMACNA SRMGMS. Anchor risers in the center of the vertical run to allow ends of riser free vertical movements. Attach supports only to structural framing members and concrete slabs. Do not anchor supports to metal decking unless a means is provided and approved for preventing the anchors from puncturing the metal decking. Where supports are required between structural framing member, provide suitable intermediate metal framing. Where C clamps are used, use retainer clips.
  1. Flexible Connectors: Provide flexible connectors between fans and ducts or casings and where ducts are of dissimilar metals. For round ducts, securely fasten flexible connectors by zinc-coated steel clinch-type draw-bands. For rectangular ducts, lock flexible connectors to metal collars.
- E. Provide duct test holes where indicated and required for testing and balancing purposes.

END OF SECTION 233300

## SECTION 233700 - AIR OUTLETS AND INLETS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Diffusers.
- B. Registers/Grilles.

#### 1.2 RELATED SECTIONS

- A. Division 09 Section "Painting": Painting of ductwork visible behind outlets and inlets.

#### 1.3 REFERENCES

- A. ADC 1062 - Certification, Rating and Test Manual.
- B. AMCA 500 - Test Method for Louvers, Dampers and Shutters.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices
- D. ARI 650 - Air Outlets and Inlets.
- E. ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
- F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- G. ASTM E413 - Classification for Rating Sound Insulation.
- H. SMACNA - HVAC Duct Construction Standard - Metal and Flexible.
- I. NFPA 70 - National Electrical Code.
- J. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01 Section "Submittal Procedures."
- B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets indicating type, size, application, rated airflow, noise level, pressure drop, and throw distance as applicable. Submit both manufacturer's standard performance tables and graphs, AND tabulated selection data specific to this project. NOTE: Submittals without complete and sufficient information, to verify the performance specified and scheduled on the Drawings, shall be rejected.

## 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Closeout Procedures."
- B. Record actual locations of air outlets and inlets.

## 1.6 QUALITY ASSURANCE

- A. Test and rate air outlet and inlet performance in accordance with ADC Equipment Test Code 1062 and ASHRAE 70.
- B. Test and rate louver performance in accordance with AMCA 500.

## 1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Diffusers, Registers and Grilles:
  - 1. Titus.
  - 2. Anemostat.
  - 3. Krueger.
  - 4. Metalaire.
  - 5. Price.

### 2.2 RECTANGULAR CEILING DIFFUSERS

- A. Type: Square and rectangular, multi-louvered directional diffuser to discharge air in pattern as indicated. Removable and interchangeable core for cleaning and changing patterns without tools.
- B. Frame: Surface mount, inverted T-bar, snap-in, or spline type, as indicated and as required to be compatible with ceiling. In plaster ceilings, provide plaster frame and ceiling frame.
- C. Fabrication: Steel with baked enamel off-white finish.

### 2.3 CEILING TRANSFER GRILLES

- A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical or horizontal face as indicated. Equal to Titus 50F or approved equal.
- B. Frame: 1-1/4 inch (32 mm) margin with concealed mounting.
- C. Fabrication: Steel with 20 gauge (0.90 mm) minimum frames and 22 gauge (0.80 mm) minimum blades, steel and aluminum with 20 gauge (0.90 mm) minimum frame, or aluminum



extrusions, as indicated, with factory off-white enamel finish.

#### 2.4 FILTER RETURN GRILLES

- A. R-1 grilles shall be equal to Metalaire series SRHF-6 GS with 1" thick throwaway filter, or approved equal. Grille shall be sized for 2' x2' T-bar Lay-in.
- B. R-2 grille shall be equal to Metalaire series CC5FD-6 GS with 1" thick throwaway filter, or approved equal. Grille shall be sized for 4' x2' T-bar Lay-in.

#### 2.5 CEILING EXHAUST GRILLES

- A. Type: Streamlined blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing, with blades set at 45 degrees, vertical or horizontal face as indicated. Equal to Titus 50F or approved equal.
- B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting.
- C. Fabrication: Steel with 20 gauge (0.90 mm) minimum frames and 22 gauge (0.80 mm) minimum blades, steel and aluminum with 20 gauge (0.90 mm) minimum frame, or aluminum extrusions, as indicated, with factory off-white enamel finish.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.
- C. Install diffusers to ductwork with air tight connection.
- D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.
- E. Paint ductwork visible behind air outlets and inlets matte black. Refer to Division 09 Section "Painting."
- F. Surfaces exposed to view shall be clean, and free of stains, smudges, and scratches.

END OF SECTION 233700

## SECTION 235100 - BREECHINGS, CHIMNEYS, AND STACKS

### 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 the following:
  - 1. Listed coaxial vent products.

#### 1.3 SUBMITTALS

- A. Product Data: For the following:
  - 1. Building-heating-appliance chimneys.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, methods of field assembly, components, hangers and seismic restraints, and location and size of each field connection.
  - 2. For installed products indicated to comply with design loads, include calculations required for selecting seismic restraints and structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Welding certificates.
- D. Manufacturer Seismic Qualification Certification: Submit certification that factory-fabricated breeching, chimneys, and stacks; accessories; and components will withstand seismic forces defined in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment." Include the following:
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
    - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
  - 2. Dimensioned Outline Drawings of Breeching, Chimneys, and Stacks: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of anchorage devices on which the certification is based and their installation requirements.
- E. Warranty: Special warranty specified in this Section.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain listed system components through one source from a single manufacturer.

- B. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code--Steel," for hangers and supports and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in vents, breechings, and stacks.
- C. Certified Sizing Calculations: Manufacturer shall certify venting system sizing calculations.

#### 1.5 COORDINATION

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

#### 1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of venting system that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, structural failures caused by expansion and contraction.
  - 1. Warranty Period: 10 years from date of Substantial Completion.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Heatfab
  - 2. Simpson Dura-Vent
  - 3. Approved equal.

#### 2.2 BREECHING AND CHIMNEY SYSTEM

- A. The entire boiler breeching and chimney system shall be stainless steel coaxial vent and air supply system. System shall be listed and tested for use with building heating equipment, in compliance with NFPA 211. Material shall comply with the following:
- B. Boiler breeching and chimney components, supports and terminations shall be factory prefabricated, and shall be tested and listed by the Underwriters Laboratory, Inc., for use with building heating equipment burning gas as described in NFPA 211, Chapter 2.
- C. The system shall maintain airtight integrity at pressures up to 72 inches of water column.
- D. Inner pipe joints shall be sealed as specified in the manufacturer's installation instructions.
- E. The breeching and vent stack shall comply with national Safety Standards and all national and local building codes.
- F. The entire breeching and chimney system from the boiler to the termination; including accessories, except as noted; shall be from one manufacturer.
- G. The breeching and chimney system shall be installed according to the manufacturer's installation instructions and shall comply with the local codes or standards.

- H. Chimney shall terminate at a height above the roof as indicated on drawings, with vent cap.
- I. The chimney shall be self supporting, without the need for guy wires or intermediate supports, to a maximum of 9'-0" in height.
- J. When installed according to the manufacturer's installation instructions, the breeching, chimney and its supporting system shall resist side loads (whether system is horizontal or vertical) at least 1.5 times the weight per foot of the piping. Plate supports shall support (as verified by manufacturer testing) 200 feet of vent stack in 6 inch through 20 inch ID sizes and 100 feet of vent stack in 24 inch ID and larger sizes with a factor of safety of at least four (4).
- K. Technical Services Support: The factory-built modular breeching and chimney system shall be provided by a vendor organization which assures design, installation and services coordination.
- L. The breeching and chimney shall be warranted against functional failure due to defects in material and manufacturer's workmanship for a period of ten years from date of delivery. The following two actions shall be performed by the Contractor:
  - 1. Drawings showing the actual layout and drawn to scale shall be provided by the manufacturer. The system shall be installed as designed by the manufacturer and in accordance with the terms of the manufacturer's 10 year warranty and in conjunction with sound engineering practice.
  - 2. The inner diameter for breeching and stack system shall be verified by the manufacturer's computations. The computation shall be technically sound, shall follow ASHRAE calculation methods, and incorporate the specific flow characteristics of the inner pipe. The contractor shall provide the exact boiler model and operating characteristics to the factory representative. Operating characteristics shall include flue gas flow rate, BTU, input, outlet temperature, local altitude, stack layout, and available external pressure at boiler outlet, etc., necessary to determine system operation at maximum and minimum levels of burner turndown range. Notify the engineer if the manufacturer's calculated inner diameter differs from that indicated.
- M. Accessories, UL labeled:
  - 1. Bellows joint (lined) as required by manufacturer to compensate for linear thermal expansion.
  - 2. Stack Termination Cap Assembly.
  - 3. Accessories as required by the manufacturer for manufacturer approved installation and support of system.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLICATION

- A. Listed, Refractory-Lined Metal Breechings and Chimneys: Freestanding boiler vents, oven vents, water heaters, exhaust for engines, fireplaces, and other solid-fuel-burning appliances.

### 3.3 INSTALLATION OF LISTED VENTS AND CHIMNEYS

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Seal between sections of positive-pressure vents according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- C. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- D. Slope breechings down in direction of appliance, with condensate draining into appliance.
- E. Lap joints in direction of flow.
- F. Join sections with acid-resistant joint cement to provide continuous joint and smooth interior finish.
- G. Erect stacks plumb to finished tolerance of no more than 1 inch (25 mm) out of plumb from top to bottom.

### 3.4 CLEANING

- A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- B. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- C. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

END OF SECTION 235100

## SECTION 235216 - CONDENSING BOILERS

### 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 packaged, factory-fabricated and assembled, gas-fired, condensing boiler, trim, and accessories for generating heating hot water for the entire facility.

#### 1.3 SUBMITTALS

- A. Product Data: Include performance data, operating characteristics, furnished specialties, and accessories.
- B. Source quality-control test reports.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.
- E. Warranty: Special warranty specified in this Section.
- F. Other Informational Submittals:
  - 1. ASME Stamp Certification and Report: Submit "H" stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

#### 1.4 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. ASME Compliance: Fabricate and label boilers to comply with ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IESNA 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N, "Uniform Test Method for Measuring the Energy Consumption of Furnaces and Boilers."

- E. UL Compliance: Test boilers for compliance with UL 795, "Commercial-Industrial Gas Heating Equipment." Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.

## 1.5 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Condensing Boilers:
    - a. Parts Excluding Heat Exchanger: 2 years from date of Substantial Completion.
    - b. Heat Exchanger Damaged by Thermal Stress and Corrosion: Ten years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Viessmann
  - 2. Buderus
  - 3. Approved equal

### 2.2 MANUFACTURED UNITS

- A. Description: Factory-fabricated, assembled and tested, water-jacketed condensing boiler with stainless steel heat exchanger sealed pressure tight, built for wall mounting; including insulated jacket; flue-gas vent; water supply, return, and condensate drain connections; and controls.
- B. Primary Heat Exchanger: Minimum of stainless steel.
- C. Secondary Heat Exchanger: Minimum of copper nickel alloy.
- D. Burner: Natural gas, forced draft.
- E. Gas Train: Combination gas valve with manual shutoff and pressure regulator. Include 100 percent safety shutoff with electronic flame supervision.
- F. Ignition: Electric-spark ignition with 100 percent main-valve shutoff with electronic flame supervision.
- G. Casing:
  - 1. Jacket: Sheet metal, with snap-in or interlocking closures.
  - 2. Control Compartment Enclosures: NEMA 250, Type 1A.
  - 3. Finish: Powder-coated protective finish.
  - 4. Insulation: Insulation surrounding the heat exchanger.
  - 5. Combustion-Air Connections: Inlet and vent duct collars.
  - 6. Mounting base to secure boiler to wall.

- H. Integrated features:
  1. Main gas train.
  2. Integrated boiler control.
  3. High limit thermostat, manual reset 100 deg F -197 deg F.
  4. High exhaust pressure switch, manual reset.
  5. Low Water Cut-off, probe type, manual reset.
  6. Air switch, differential pressure type.
  7. Combustion blower, variable speed.
  8. Condensate treatment assembly

### 2.3 TRIM

- A. Safety Relief Valve: ASME rated.
- B. Pressure and Temperature Gage: Minimum 3-1/2-inch- (89-mm-) diameter, combination water-pressure and -temperature gage. Gages shall have operating-pressure and -temperature ranges so normal operating range is about 50 percent of full range.
- C. Boiler Air Vent: Automatic.
- D. Drain Valve: Minimum NPS 3/4 (DN 20) hose-end gate valve.

### 2.4 CONTROLS

- A. Refer to Division 23 Section "Instrumentation and Control for Mechanical Systems."
- B. Microprocessor-based combination PID temperature control and flame management.
- C. On-board digital touch-pad user interface.
- D. Boiler operating controls shall include the following devices and features:
  1. Control transformer.
  2. Set-Point Adjust: Set points shall be adjustable.
  3. Operating Pressure Control: Factory wired and mounted to cycle burner.
    - a. Low-Water Cutoff
- E. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
  1. High Cutoff: Manual reset stops burner if operating conditions rise above maximum boiler design temperature.
  2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be manual-reset type.
  3. Blocked Inlet Safety Switch: Manual-reset pressure switch field mounted on boiler combustion-air inlet.
  4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.
- F. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.



1. Hardwired Points:
  - a. Monitoring: On/off status, common trouble alarm, low water level alarm, .
  - b. Control: On/off operation, hot water supply temperature set-point adjustment.
2. A communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. Control features available, and monitoring points displayed, locally at boiler control panel shall be available through building automation system.

## 2.5 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified on the drawings.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
  1. House in NEMA 250, Type 1 enclosure.
  2. Wiring shall be numbered and color-coded to match wiring diagram.
  3. Install factory wiring outside of an enclosure in a metal raceway.
  4. Field power interface shall be to circuit breaker.
  5. Provide branch power circuit to each motor and to controls.
  6. Provide each motor with overcurrent protection.

## 2.6 SOURCE QUALITY CONTROL

- A. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- B. Test and inspect factory-assembled boilers, before shipping, according to ASME Boiler and Pressure Vessel Code.
- C. Allow Owner access to source quality-control testing of boilers. Notify Architect 14 days in advance of testing.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Before boiler installation, examine roughing-in for wall mounting of boilers, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting boiler performance, maintenance, and operations.
  1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 BOILER INSTALLATION

- A. Vibration Isolation: Elastomeric with a minimum static deflection of 0.25 inch (6.35 mm) >. Vibration isolation devices and installation requirements are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Assemble and install all boiler accessories
- E. Install electrical devices furnished with boiler but not specified to be factory mounted.
- F. Install control wiring to field-mounted electrical devices.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install piping from equipment drain connection to nearest floor drain. Piping shall be at least full size of connection. Provide an isolation valve if required.
- D. Connect piping to boilers, except safety relief valve connections, with flexible connectors of materials suitable for service. Flexible connectors and their installation are specified in Division 23 Section "Common Work Results for HVAC."
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tappings with shutoff valve and union or flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.
- H. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- I. Boiler Venting:
  - 1. Install flue venting kit and sealed combustion-air intake.
  - 2. Connect full size to boiler connections. Comply with requirements in Division 23 Section "Breechings, Chimneys, and Stacks."
- J. Ground equipment according to National Electric Code.
- K. Connect wiring according to National Electric Code.

### 3.4 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 components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. Perform installation and startup checks according to manufacturer's written instructions.
  - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.
  - 3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
  - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
    - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level and water temperature.
    - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. 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 during other than normal occupancy hours for this purpose.
- E. Performance Tests:
  - 1. Engage a factory-authorized service representative to inspect component assemblies and equipment installations, including connections, and to conduct performance testing.
  - 2. Boilers shall comply with performance requirements indicated, as determined by field performance tests. Adjust, modify, or replace equipment to comply.
  - 3. Perform field performance tests to determine capacity and efficiency of boilers.
    - a. Test for full capacity.
    - b. Test for boiler efficiency at low fire 20, 40, 60, 80, 100, 80, 60, 40, and 20 percent of full capacity. Determine efficiency at each test point.
  - 4. Repeat tests until results comply with requirements indicated.
  - 5. Provide analysis equipment required to determine performance.
  - 6. Provide temporary equipment and system modifications necessary to dissipate the heat produced during tests if building systems are not adequate.
  - 7. Notify Architect in advance of test dates.
  - 8. Document test results in a report and submit to Architect.

### 3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain boilers

END OF SECTION 235216

## SECTION 237200 – AIR-TO-AIR ENERGY RECOVERY EQUIPMENT

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Packaged Air-to-Air Energy Recovery Units.

#### 1.2 RELATED SECTIONS

- A. Division 23 Section “Motors, Drives, and Accessories.”
- B. Division 23 Section “Identification for HVAC Piping and Equipment.”
- C. Division 23 Section “Duct Insulation.”
- D. Division 23 Section “Air Duct Accessories”: Flexible duct connections.
- E. Division 26 “Electrical”.

#### 1.3 REFERENCES

- A. Division 01 Section “Quality Requirements”
- B. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings.
- C. ABMA STD 11 - Load Ratings and Fatigue Life for Roller Bearings.
- D. AMCA 99 - Standards Handbook.
- E. AMCA 210 - Laboratory Methods of Testing Fans for Rating.
- F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans.
- G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- H. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- I. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.
- J. ANSI/UL 900 - Test Performance of Air Filter Units.
- K. ARI 410 - Standard for Forced-Circulation Air-Cooling and Air-Heating Coils.
- L. ARI 430 - Standard for Central-Station Air-Handling Units.
- M. ASHRAE 68 - Laboratory Method of Testing In-Duct Sound Power Measurement Procedure for Fans.
- N. NEMA MG1 - Motors and Generators.

- O. NFPA 70 - National Electrical Code.
- P. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.
- Q. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.
- R. UL 900 - Standard for Air Filter Units.
- S. UL - Fire Resistance Directory.
- T. UL 1995 - Heating and Cooling Equipment

#### 1.4 SUBMITTALS

- A. Division 01 Section “Submittal Procedures”.
- B. Product Data:
  1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, operation and service clearances, and electrical characteristics and connection requirements. Indicate lift points and recommendations and center of gravity. Indicate unit shipping, installation and operating weights including dimensions.
  2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.
  3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.
  4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.
  5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring. Include recommended wire and fuse sizes or MCA, sequence of operation, connection points, safety and start-up instructions.
  6. Submit unit performance including: capacity, nominal and operating performance.
  7. Submit Mechanical Specifications for unit and accessories describing construction, components and options.
- C. Unit Manufacturer shall verify in writing that equipment will be compatible with existing Delta Controls building management system, installed and maintained by IB Controls, 3 Pope Road, Windham, ME 04062.

#### 1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Division 01 Section “Closeout Procedures”: Procedures for submittals.
- B. Maintenance Data: Include instructions for lubrication, filter replacement, motor and drive replacement, spare parts lists, and wiring diagrams.

#### 1.6 QUALITY ASSURANCE

- A. Energy Recovery Units: Product of manufacturer regularly engaged in production of components, who issues complete catalog data on product offering. Manufacturer shall have minimum three years experience.

- B. Energy Recovery Units: Certify air volume, static pressure, fan speed, brake horsepower and selection procedures in accordance with ARI 430. If air handling units are not certified in accordance with ARI 430, Contractor shall be responsible for expenses associated with testing of units after installation to verify performance of fan(s). Any costs incurred to adjust fans to meet scheduled capacities shall be the sole responsibility of the Contractor.
- C. Air Coils: Certify capacities, pressure drops and selection procedures in accordance with ARI 410-91.

#### 1.7 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

#### 1.8 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 Section “Product Requirements”: Transport, handle, store, and protect products.
- B. Units shall ship fully assembled up to practical shipping and rigging limitations. Units shipped not fully assembled shall have tags and airflow arrows on each section to indicate location and orientation in direction of airflow. Each section shall have lifting lugs to allow for field rigging and final placement of section.
- C. Deliver units to site with fan motors, sheaves, and belts completely assembled and mounted in units.
- D. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.
- E. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

#### 1.9 ENVIRONMENTAL REQUIREMENTS

- A. Division 01 Section “Product Requirements”: Environmental conditions affecting products on site.
- B. Do not operate units for any purpose, temporary or permanent, until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

#### 1.10 EXTRA MATERIALS

- A. Division 01 Section “Closeout Procedures.”
- B. Provide one set of filters for each unit, to the Owner in clean, sealed containers.

### PART 2 - PRODUCTS

#### 2.1 AIR-TO-AIR HEAT RECOVERY UNITS

- A. Approved Manufacturers:
  - 1. Venmar.
  - 2. Lossnay.
  - 3. RenewAire.
  - 4. Xetex.
  
- B. General:
  - 1. Factory assembled unit, consisting of fan and motor assemblies (supply and exhaust if included), Air-To-Air Plate Heat Exchanger, necessary dampers, filters, drain pans if needed, wiring and controls. Unit shall be controlled by start/stop signal from the building's automatic temperature control system with control devices provided by unit manufacturer. Unit shall have single point power connection. Provide contact points as required for interface of start/stop signal from the building's automatic temperature control system - coordinate with Division 23 – Instrumentation and Control for Mechanical Systems.
  - 2. Motor and Electrical Components: Refer to Division 23 — Motors, Drives, and Accessories for motor requirements.
  
- C. Unit Cabinet:
  - 1. The unit shall include a latched and hinged removable door to provide access to blower(s) energy recovery core and filters.
  
- D. Air-To-Plate Heat Exchanger: The air to air plate heat exchanger shall be a cross-flow type and shall meet NFPA 90A and 90B requirements for flame spread and smoke generation.
  
- E. Fans:
  - 1. Testing Requirements: Fan performance ratings for flow rate, pressure, power, air density, speed of rotation, and efficiency shall be factory tested.
  - 2. Fan Section Construction: Fan and motors shall be mounted inside the casing.
  
- F. Filters:
  - 1. Filters shall comply with NFPA Standard 90A (Class I or II) "Standard for the Installation of Air Conditioning and Ventilating Systems."
  - 2. Filter Section: Outside air inlet shall be equipped with galvanized steel racks to provide for slide out removal of filters, with filter media holding frames arranged for flat orientation.
  
- G. Warranty: Manufacturer shall provide 2 year warranty on parts, and 10 years on the air to air plate heat exchanger excluding labor. Warranties of less duration shall not be acceptable.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Division 01 Section "Quality Requirements": Manufacturer's instructions.
- B. Install in accordance with ARI 435.

- C. Install flexible connections specified in Division 23 Section “Air Duct Accessories” between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch (25 mm) flex between ductwork and fan while running.
- D. Install assembled unit on vibration isolators.
- E. Make connections to drain pan with unions or flanges, if drain pan is included.
- F. Extend coil drain pan ports (if included) through the unit housing and terminate with ball valves and caps. Provide sealing collars or grommets at penetrations through unit housing to eliminate air leakage.

### 3.2 TESTING

- A. After the entire installation is completed, ready for operation, test the systems. The Owner will provide electric current for the tests. Provide necessary labor, test pump, gauges, meters, other instruments and materials. Perform tests in the presence of the Architect. Unit shall operate without objectionable noise.

### 3.3 CLEANING

- A. The entire system installations including apparatus, motors, inside of ducts, and other components, shall be left in first-class condition including cleaning, oiling and packing.
- B. Provide filters at system start-up. Replace filters after air systems have been adjusted and balanced. Provide the Owner with one additional set of filters for air handling units.

### 3.4 ADJUSTMENTS

- A. After completion of the installation work called for in this Specification, furnish necessary Mechanics or Engineers for the adjustment and operation of the plant, to the end that the plant may be perfectly adjusted and turned over to the Owner in perfect working order. Further instruct the Owner's authorized representative in the care and operation of the installation, providing required framed instruction charts, directions, and other relevant information and documentation.

### 3.5 NAMEPLATES, TAGS AND CHARTS

- A. Provide engraved plastic nameplates to identify equipment, controls, and other components.

### 3.6 ALTERATIONS

- A. Execute alterations, additions, removals, relocations or new work, and other work, as indicated or required to provide a complete installation in accordance with the intent of the Drawings and Specifications.
- B. Any existing work disturbed or damaged by the alterations or new work shall be repaired or replaced to the Architect's satisfaction and at no additional cost to the Owner.
- C. Existing ductwork, piping, and other systems, indicated to be removed, shall be removed from



the site. Cap off existing services remaining. The Owner retains the right to ownership of heating and ventilating equipment scheduled to be removed; store such equipment where requested by the Owner. Material not retained by the Owner shall be removed from the site.

### 3.7 CONTINUITY OF SERVICE

- A. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted service for the building or any of its locations. Any unavoidable conditions requiring reduced building capacity shall be arranged for by programming with the Owner's duly authorized representative at the building subject to the Architect's approval. If necessary, temporary work shall be installed to provide for the condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal service shall be performed during an overtime period to be scheduled with the Owner. Costs for overtime work shall be included in the bid.

END OF SECTION 237200

## SECTION 237413 – PACKAGED, OUTDOOR, CENTRAL-STATION, AIR-HANDLING UNITS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Packaged roof top unit.
- B. Refrigeration Components.
- C. Unit controls.
- D. Remote panel.
- E. Roof mounting curb and base.
- F. Maintenance service.

#### 1.2 RELATED SECTIONS

#### 1.3 REFERENCES

- A. ARI 210 - Unitary Air-Conditioning Equipment.
- B. ARI 240 - Air Source Unitary Heat Pump Equipment.
- C. ARI 270 - Sound Rating of Outdoor Unitary Equipment.
- D. ARI 360 - Unitary Air-Conditioning Equipment.
- E. ARI 370 - Sound Rating of Large Outdoor Refrigerating and Air Conditioning Equipment.
- F. ANSI/ASHRAE 90A - Energy Conservation in New Building Design
- G. NFPA 70 - National Electrical Code.
- H. ANSI/NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

#### 1.4 SUBMITTALS

- A. Division 01 Section “Submittal Procedures.”
- B. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- C. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating

instructions, installation instructions, maintenance and repair data, and parts listing. Submit in accordance with Division 01 Section "Operation and Maintenance Data."

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

#### 1.6 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.
- B. Unit shall conform to UL 1995/CSA 22.2 #236 for construction of packaged air conditioner and shall have UL/CSA label affixed to rooftop package.
  - 1. In the event the unit is not UL/CSA approved, the manufacturer shall, at his expense, provide for a field inspection by a UL/CSA representative to verify conformance to UL/CSA standards. If necessary, contractor shall perform required modifications to the unit to comply with UL/CSA, as directed by the UL/CSA representative, at no additional expense to the Owner.

#### 1.7 DELIVERY, STORAGE, AND PROTECTION

- A. Division 01 Section "Product Requirements": Transport, handle, store, and protect products.
- B. Protect units from physical damage by storing off site until roof mounting curbs are in place, ready for immediate installation of units.

#### 1.8 WARRANTY

- A. Provide a full parts warranty for one year from substantial completion.
- B. Provide five year extended warranty for compressors including materials only.
- C. Provide five year limited warranty for heat exchanger including materials only.

#### 1.9 MAINTENANCE SERVICE

- A. Division 01 Section "Closeout Procedures."
- B. Furnish service and maintenance of packaged roof top units for one year from Date of Substantial Completion.
- C. Provide maintenance service with a two month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.
- D. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of six filter replacements, minimum of one fan belt replacement, and controls check-out, adjustments, and recalibration.
- E. Submit copy of service call work order or report, and include description of work performed.

## 1.10 ACOUSTICS

- A. Manufacturer of packaged rooftop equipment shall provide indoor and outdoor sound power level data across major octave band center frequencies for cataloged operating range of unit at gross cooling capacity range. Data shall be obtained in conformance with ANSI S1.32-1980, American National Standard Methods for the Determination of Sound Power Levels of Discrete Frequency and Narrow Band Noise Sources in Reverberation Rooms and per AMCA Standard 300-85 test code "Sound Rating Air Moving Devices".

## 1.11 EXTRA MATERIALS

- A. Division 01 Section "Closeout Procedures."
- B. Provide one set of filters.

## PART 2 - PRODUCTS

### 2.1 PACKAGED ROOFTOP UNITS

- A. Approved Manufacturers:
  - 1. Trane Voyager with Relia Tel Controls.
  - 2. Lennox Emergence.
  - 3. Approved equal.
- B. Air Conditioning Units:
  - 1. General: Roof mounted units having electric refrigeration.
  - 2. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.
  - 3. Disconnect Switch: Factory mount disconnect switch on equipment under provisions of Division 26.
- C. Fabrication:
  - 1. Cabinet: Galvanized steel with baked enamel finish, access doors or removable access panels with quick fasteners, locking door handle type with piano hinges. Structural members shall be minimum 18 gauge (1.20 mm), with access doors or removable panels of minimum 20 gauge (0.90 mm).
  - 2. Insulation: One inch (25 mm) thick neoprene coated glass fiber with edges protected from erosion.
  - 3. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, and rubber isolated hinge mounted high efficiency motor or direct drive as indicated.
  - 4. Air Filters: 2 inch (50 mm) thick glass fiber disposable media in metal frames equal to MERV 8.
  - 5. Roof Mounting Curb: 24 inches (610 mm) high galvanized steel, channel frame with gaskets, nailer strips.
- D. Evaporator Coil:
  - 1. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.
  - 2. Provide capillary tubes or thermostatic expansion valves for units of 6 tons (21 kw)

capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons (26 kw) cooling capacity and larger.

- E. Compressor:
  - 1. Provide scroll compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.
  - 2. Five minute timed off circuit to delay compressor start.
  - 3. Outdoor thermostat to energize compressor above 57 EF (14 EC) ambient.
  - 4. Provide step capacity control by cycling compressors.
  
- F. Condenser Coil:
  - 1. Provide copper tube aluminum fin coil assembly with subcooling rows.
  - 2. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Provide high efficiency fan motors.
  
- G. Mixed Air Casing:
  - 1. Dampers: Provide outside, return, and relief dampers with damper operator and control package. Outside air damper to remain fully closed and return to remain fully open under normal operation. Outside air damper shall fully open and return damper shall fully open in economizer cooling mode. Relief dampers may be gravity balanced.
  - 2. Damper Operator: 24 volt with gear train sealed in oil with spring return on units 7.5 ton (26 kw) cooling capacity and larger.

## 2.2 OPERATING CONTROLS

- A. Provide terminal strip on unit for connection of operating controls to remote panel by IB Controls. Control shall allow for two stages of cooling.
  
- B. Provide Relia Tel Refrigeration Module (RTRM) and Relia Tel Options Module (RTOM) to provide multi-speed fan operation.
  - 1. Fan shall operate at minimum speed (63%) when the unit is in: fan only mode, economizer cooling mode, or stage 1 of mechanical cooling mode.
  - 2. Fan shall operate at full speed (100%) during stage 2 of mechanical cooling mode.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Division 01 Section "Project Management and Coordination": Verification of existing conditions prior to beginning work.
  
- B. Verify that roof is ready to receive work and opening dimensions are as indicated on Shop Drawings.
  
- C. Verify that proper power supply is available.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Install in accordance with NFPA 90A.
- C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

### 3.3 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Division 01 Section "Quality Requirements."
- B. Provide initial start-up and shut-down during first year of operation, including routine servicing and check-out.
- C. Manufacturer shall furnish a factory trained service engineer without additional charge to start the unit(s) and to coordinate interface with building's ATC system (coordinate with Division 23 Section "Instrumentation and Controls for HVAC"). Packaged rooftop unitary manufacturers shall maintain service capabilities no more than 100 miles from the jobsite.

END OF SECTION 237413

## SECTION 238200 – CONVECTION HEATING UNITS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Finned Tube Radiation.

#### 1.2 RELATED SECTIONS

- A. Division 23 Section “Hydronic Piping.”
- B. Division 23 Section “Hydronic Specialties.”
- C. Division 23 Section “Instrumentation and Control for Mechanical Systems”
- D. Division 26 “Electrical”- Equipment Wiring Systems: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

#### 1.3 REFERENCES

- A. NFPA 70 - National Electrical Code.

#### 1.4 SUBMITTALS FOR REVIEW

- A. Division 01 Section “Submittal Procedures.”
- B. Product Data: Provide typical catalog of information including arrangements.
- C. Shop Drawings:
  - 1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
  - 2. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.
  - 3. Indicate mechanical and electrical service locations and requirements.

#### 1.5 SUBMITTALS AT PROJECT CLOSEOUT

- A. Division 01 Section “Closeout Procedures”: Procedures for submittals.
- B. Project Record Documents: Record actual locations of components and locations of access doors in radiation cabinets required for access or valving.
- C. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owners name and registered with manufacturer.
- D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings. Submit under provisions of Division 01.

#### 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

## 1.7 REGULATORY REQUIREMENTS

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

## PART 2 - PRODUCTS

### 2.1 FINNED TUBE RADIATION

- A. Manufacturers:
  - 1. Sterling.
  - 2. Vulcan.
  - 3. Slant-Fin.
- B. Heating Elements: 1 inch (25 mm) ID steel piping, mechanically expanded into evenly spaced aluminum fins sized as scheduled.
- C. Element Hangers: Quiet operating, ball bearing cradle type providing unrestricted longitudinal movement, on enclosure brackets.
- D. Enclosures: 16 ga. steel up to 10.75 inches (450 mm) in height with easily jointed components for wall to wall installation. Support rigidly, on wall brackets at least 3 feet (1000 mm) on center maximum.
- E. Finish: Factory applied baked enamel of color as selected.
- F. Damper: Provide internal damper at enclosure air outlet.
- G. Capacity: As scheduled, based on 65°F (18°C) entering air temperature, 170°F average water temperature.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install equipment exposed to finished areas after walls and ceiling are finished and painted. Avoid damage.
- C. Protection: Provide finished cabinet units with protective covers during balance of construction.
- D. Finned Tube Radiation: Locate on outside walls and run cover wall-to-wall unless otherwise indicated. Where drawings show elements located under windows, install with elements centered under windows. Install wall angles where units butt against walls.



- E. Hydronic Units: Provide with shut-off valve on supply and lockshield balancing valve on return piping. If not easily accessible, extend vent to exterior surface of cabinet for easy servicing. For unit heaters, provide float operated automatic air vents with stop valve.

### 3.2 CLEANING

- A. After construction is completed, including painting, clean exposed surfaces of units. Vacuum clean coils and inside of cabinets.
- B. Touch-up marred or scratched surfaces of factory-finished cabinets, using finish materials furnished by manufacturer.

END OF SECTION 238200

## 260010 - BASIC ELECTRICAL REQUIREMENTS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to all Division 26 Sections.
- B. Intent Is to Provide and Install Complete Electrical Systems, as required to accommodate the renovations to the existing Building.
- C. Access Panels: Where required by NFPA 70 (N.E.C.)
- D. All Cable Bundles Shall Be Limited to a Maximum of 12 Cables, Individual Bundles of Cables Shall Be Separated by at Least 2 Inches in All Directions.

#### 1.2 RELATED REQUIREMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section. Examine all contract documents for requirements affecting the work.

#### 1.3 DEFINITIONS

- A. As used in this section, "provide" shall mean, "furnish and install". "Furnish" shall mean "to purchase and deliver to the project site complete with every necessary appurtenance and support", and "Install" shall mean "to unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project".

#### 1.4 WORK BY OWNER

- A. The Owner will be responsible for installation and testing of all voice/data cabling. This work will include all outlets/jacks, cabling, terminations and testing at station and rack ends.

#### 1.5 SUBSTITUTIONS

- A. Refer to Division 01 for Substitutions and Product Options.

#### 1.6 ALLOWANCES

- A. None.

#### 1.7 ALTERNATES

- A. None.

#### 1.8 REFERENCES

- A. NEMA Standards.

- B. NECA "Standard of Installation."
- C. NFPA 70 (N.E.C.) latest edition.
- D. NFPA 101 Life Safety Code.
- E. U.L. Standards.
- F. ANSI Standards.
- G. Maine Uniform Building and Energy Codes (MUBEC) which include provisions of:
  - 1. (IBC) International Building Code
  - 2. (IEBC) International Existing Building Code
  - 3. (IRC) International Residential Code
  - 4. (IECC) International Energy Conservation Code
  - 5. ASHRAE 62.1 Ventilation for Acceptable Indoor Air Quality
  - 6. ASHRAE 62.2 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
  - 7. ASHRAE 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings
  - 8. ASTM E1465-06 Radon Standard for new residential construction - (Maine Model Standard)

#### 1.9 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Include products specified in Division 26 individual sections.
- C. Submit Shop Drawings and product data grouped by individual Sections to include complete submittals of related systems, products, and accessories. Label each with Section number and title. Partial Section submittals will not be reviewed.
- D. Include access panels.
- E. Include fire-stop seals and fillers.

#### 1.10 RECORD DRAWINGS

- A. Submit under provisions of Division 01 Section "Project Management and Coordination".
- B. Keep a marked set of Drawings at the site as a record set indicating all revisions in the work as the work progresses. At the completion of the work, mark the Drawings "As-Built Drawings" with the Contractor's name and date, and deliver to the Architect.

#### 1.11 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of the latest edition of ANSI/NFPA 70 National Electrical Code (N.E.C.).
- B. Conform to requirements of all local, State and Federal laws and regulations, plus local electric utility company's rules, and the Fire Underwriters' requirements.

- C. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- D. Secure and pay for all permits and certificates as required by local, State and Federal laws.
- E. Request inspections from authority having jurisdiction.
- F. Run separate circuits for lighting and receptacle outlets as indicated.
  - 1. Circuits shall be balanced and loads and capacities shall be in accordance with requirements of local electric light company and National Board of Fire Underwriters.
  - 2. Do not share neutral on branch circuits.
- G. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.
- H. The Drawings indicate only diagrammatically the extent, layout and the general location and arrangement of equipment, conduit and wiring. Become familiar with all details of the work and verify all dimensions in the field so that the outlets and equipment will be properly located and readily accessible.
  - 1. Note that drawings do not show all junction boxes and fixture whips for lighting fixtures recessed in accessible ceilings. Although not specifically shown on the drawings, these fixtures shall be wired from junction boxes and 6'-0" unsupported whips. Provide number of junction boxes as required to allow for the 6'-0" whips. Wiring from fixture to fixture is not allowed. See Division 26 Section "Luminaires".
  - 2. Lighting and Devices shown with same panel and circuit designation with no home run symbol may share same home runs to panelboards provided that the furthest device on the circuit does not exceed 2-1/2% voltage drop.
  - 3. Where home run symbols are shown, use separate run to panelboard for each symbol, and do not share home run with other devices having same panel and circuit designation.

#### 1.12 PROJECT/SITE CONDITIONS

- A. Coordinate with all other trades to ensure proper access and space requirements.
- B. Where project conditions occur necessitating departures from the drawings, submit for approval the details of and reasons for departures prior to implementing any change.
- C. Alterations
  - 1. Visit the site and become familiar with the existing conditions, and the requirements of the Plans and Specifications. No claim will be recognized for extra compensation due to failure of becoming familiar with the conditions and extent of the proposed work.
  - 2. Execute all alterations, additions, removals, relocations, or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the Drawings and Specifications.
  - 3. Repair or replace to the Owner's satisfaction, all existing work disturbed or damaged by the alterations.
  - 4. Retain ownership and remove from site all existing materials, equipment, fixtures, wiring and devices disconnected and not reused; Pay all charges for proper disposal of materials:
    - a. Materials specifically indicated to be returned to Owner.
    - b. Deliver to Owner: Panelboards and lighting fixtures.
    - c. Obtain receipt of delivery from Owner's Representative.

5. Do not reuse existing wiring except as specifically indicated. Existing conduit raceways may be reused, provided that the existing wires are removed and new wires are installed.
6. Provide finished blank plates on all existing ceiling and wall boxes which can not be removed.
7. Ensure all circuits in existing buildings are re-energized where existing panelboards are replaced, or existing wiring is rerouted, disconnected, or disturbed. Provide and install new wiring as required to meet this condition. Verify breaker/fuse sizes on existing circuits and do not load wiring to beyond 75% of their ampacities.]

#### 1.13 SEQUENCING AND SCHEDULING

- A. Construct Work in sequence under provisions of Division 01 Section "Summary".
- B. Schedule and coordinate all work with Division 02, "Selective Structure Demolition and Alterations". Demolition and removal of electrical items are included as part of Division 26. Patching of existing structure left by removals is specified under Division 02.
- C. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted services for the occupied sections of the building. If necessary, install temporary work to provide for this condition. Authorization for interrupting services shall be obtained, in writing, from the Owner. Costs for overtime work and temporary work shall be included in the bid.

#### 1.14 TEMPORARY LIGHT AND POWER

- A. Lighting level in all areas for the duration of construction period shall be a minimum of 5 foot candles or per OSHA requirements, whichever is greater. Provide a minimum of 50 foot candles for taping and painting of all surfaces, and for surfaces receiving finishes, including flooring and tile. When permanent light fixtures are installed, these units may be used to provide required lighting level, but shall be relamped with correct lamps prior to building turnover to Owner."

### PART 2 - PRODUCTS

#### 2.1 PAINTING

- A. Refer to Division 09 Section "Painting".

#### 2.2 ACCESS PANELS

- A. Access panels required for items furnished under Division 26 shall be provided under this Division and installed under Divisions 08 and 09.
- B. Standard panels: 12" x 16" except as indicated. Doors: flush type 14-gauge steel, hinged to 16-gauge frame. Latch: Flush face screw operated. All factory primed and painted to match in the field.
  1. Same U.L. fire rating as wall, floor, or ceiling in which they are installed.
  2. Equal To: Inryco/Milcor style "M" and Miami-Carey "HM".

## PART 3 - EXECUTION

### 3.1 WORKMANSHIP AND INSTALLATION

- A. Execute all work in a neat manner acceptable to the Local and State Electrical Inspector. Follow manufacturer's installation recommendations.
- B. All electrical components and their attachments shall be properly supported and where required shall be designed for seismic forces.
- C. Lighting fixtures shall be supported from structural steel. Provide unistrut channels or equal to span between top cord of joists. See Division 26 "Luminaires".
- D. Perform all electrical work by licensed electricians well skilled in the trade and supervised by a Master Electrician.
- E. Replace or repair to new condition, defective equipment and equipment damaged during installation or testing.

### 3.2 TESTING AND ADJUSTING

- A. The entire installation shall be free from short circuits and improper grounds. Test in the presence of the Architects or their representatives.
- B. Test feeders with the feeders disconnected from the branch circuit panels.
- C. Test each individual branch circuit at the panel. In testing for insulation resistance to ground, the power equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code and the manufacturer's recommendations. Correct failure in a manner satisfactory to the Architect and Engineers.
- D. Completely test and adjust each system specified under Division 26 for proper operation.

### 3.3 SLEEVES, INSERTS AND OPENINGS

- A. Sleeves:
  - 1. Furnish and install all sleeves required for the work.
  - 2. Sleeves through exterior building walls or through concrete construction shall be rigid galvanized steel.
  - 3. Sleeves shall be sized to provide a total of not less than 1/2-inch clearance around conduit.
  - 4. Sleeves for setting into walls shall be flush with finished construction. Sleeves for setting into floor shall be embedded in concrete slab and extend approximately 2 inches above finished floors.
  - 5. All sleeved openings within building shall be sealed airtight using fire barrier caulking with a UL classification for use as a fire penetration seal for walls and floors with up to a 3-hour fire rating expanded.
  - 6. Sleeves shall be provided in all locations where cables and conduits penetrate walls and floors.
  - 7. Selection of firestopping materials and installation shall be in accordance with specifications Division 07 Section "Through Penetration Firestop Systems" for Firestopping".

END OF SECTION 260010

## SECTION 260111 – CONDUIT

### PART 1 - GENERAL

#### 1.1 WORK INCLUDES

- A. Metal Conduit.
- B. Flexible Metal Conduit.
- C. Liquidtight Flexible Metal Conduit.
- D. Electrical Metallic Tubing (EMT).
- E. Fittings and Conduit Bodies.

#### 1.2 RELATED SECTIONS

- A. Division 01 Section “Submittal Procedures”.
- B. Division 07 Section “Single-Ply Membrane Roof Patching” for penetrations.
- C. Division 07 Section “Through Penetration Firestop Systems.”
- D. Division 26 Section “Basic Electrical Requirements”.

#### 1.3 REFERENCES

- A. NECA "Standard of Installation."
- B. NEMA Standards.
- C. NFPA 70 N.E.C. latest edition.
- D. U.L. Standards.

#### 1.4 DESIGN REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 (N.E.C.)
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.
- C. Conduit Size: ANSI/NFPA 70 (N.E.C.) for conductors indicated. Increase size as required to include grounding conductors specified.

#### 1.5 SUBMITTALS

- A. Submit under provisions of Division 01 Section “Project Management and Coordination”.
- B. Include expansion fittings for all conduit types used on the project.

- C. Include fire-stop seals and fillers.

## 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01.
- B. Accurately record actual routing of conduits larger than 2 inches.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle products to site under provisions of Division 01.
- B. Accept conduit on site. Inspect for damage.
- C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

## 1.8 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to meet project conditions.
- D. Where conduit routing is not shown, and destination only is indicated, determine exact routing and lengths required.

## PART 2 - PRODUCTS

### 2.1 CONDUIT REQUIREMENTS

- A. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in minimum size 3/4 inch conduit.
- B. Underground Installations:
  - 1. More than Five Feet from Foundation Wall: Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thinwall nonmetallic conduit PVC-40 encased in concrete where indicated.
  - 2. Within Five Feet from Foundation Wall: Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thinwall nonmetallic conduit PVC-40.
  - 3. In or Under Slab on Grade:
    - a. Use rigid galvanized steel conduit, intermediate metal conduit, plastic coated steel conduit, thickwall nonmetallic conduit PVC-80 and thinwall nonmetallic conduit PVC-40.
    - b. Rise through slab in rigid galvanized steel conduit.
    - c. Conduit larger than 3/4" shall run below slab.
  - 4. Minimum Size: 3/4 inch.
  - 5. Under paved areas: rigid galvanized steel conduit or concrete encased PVC-40.
  - 6. Metallic conduits buried in soil: Coated with Bitumastic #50.



- C. Outdoor Locations, Above Grade: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.
- D. Interior Wet and Damp Locations: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.
- E. Dry Locations:
  - 1. Concealed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
  - 2. Concealed/ Accessible: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
  - 3. Exposed: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing.
    - a. Exposed conduit: Not allowed in finished areas except as specifically noted.
    - b. Finished areas: Exposed raceways specified under Division 26 Section "Surface Raceways".
- F. Panel Feeders: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing in accordance with locations herein specified.
- G. Couplings and connectors for electrical metallic tubing up to 2" shall be steel set screw or compression type. Set-screw connection shall be used for all tubing sizes with a minimum of four set-screws for coupling and two set-screws for connectors and fittings for sizes 1-1/4" and larger.
- H. Couplings and connectors for rigid and intermediate metal conduit shall be threaded.
- I. Termination for all conduit and tubing shall have insulated bushings or insulated throat connectors in accordance with code requirements.
- J. Permanent Connection to Motors: Dry locations, use flexible metal conduit. Damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. In general, all raceways shall be concealed above ceilings and within finished walls - securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be exposed overhead such that all raceways are parallel or perpendicular to joists, columns or beams and all drops to wall devices shall be concealed in walls.
- B. Install exposed only where specifically indicated.
- C. Aluminum conduits shall not be installed below grade or in poured concrete or masonry.
- D. Install conduit in accordance with NECA "Standard of Installation."
- E. Arrange supports to prevent misalignment during wiring installation.

- F. Support conduit using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
- G. Group Related Conduits:
  - 1. Support using conduit rack of Power-Strut, or approved equal.
  - 2. Parallel runs shall be neatly clustered with all bends and offsets of uniform pattern
  - 3. Provide space on each for 25 percent additional conduit.
- H. Substantially support with approved clips or hangers spaced not to exceed ten feet (10') on centers except 1/2" rigid conduit and 3/4" electrical metallic tubing shall have supports spaced not to exceed six feet (6').
- I. Fasten conduit supports to building structure.
  - 1. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
  - 2. Do not attach conduit to ceiling support wires.
  - 3. Conduits larger than 2" shall be supported from top cord of joists.
- J. Arrange conduit to maintain headroom and present neat appearance.
- K. Route conduit parallel and perpendicular to walls.
- L. Route conduit in and under slab from point-to-point.
  - 1. Install only where specifically indicated or required.
  - 2. Obtain approval from the Architect before installation.
- M. Do not cross conduits in slab.
- N. Maintain adequate clearance between conduit and piping.
- O. Maintain 6 inch clearance between conduit and surfaces with temperatures exceeding 104EF.
- P. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- Q. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction. Use factory elbows or hydraulic one-shot bender to fabricate bends in metal conduit 2 inches or larger in size.
- R. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- S. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.
- T. Provide suitable labeled nylon pull string in each empty conduit.
- U. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
- V. Use sleeves when passing through floors and walls.
- W. When serving roof top equipment, conduit shall enter within the weather-proof curbing. Maintain water tight roofing system.

- X. Ground and bond conduit under provisions of Division 26 Section “Grounding and Bonding.”
- Y. Identify conduit under provisions of Division 26 “Electrical Identification.”

3.2 FIELD QUALITY CONTROL

- A. No wire shall be installed until work which might cause damage to wires or conduits has been completed.
- B. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.

3.3 INTERFACE WITH OTHER PRODUCTS

- A. Install conduit to preserve fire-resistance rating of partitions and other elements, using approved seals, fillers and materials.

END OF SECTION 260111

## SECTION 260112 - SURFACE RACEWAYS

### PART 1 - GENERAL

#### 1.1 WORK INCLUDES

- A. Surface Metal Raceways.
- B. Multi-outlet Assemblies.
- C. Wireways.
- D. Modular Tel-Power Poles.

#### 1.2 RELATED WORK

- A. Division 26 Section "Basic Electrical Requirements".
- B. Division 26 Section "Conduit".
- C. Section 260141: Wiring Devices.
- D. Section 260170: Grounding and Bonding.

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. latest edition.
- C. U.L. Standards.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.).
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- C. Size per N.E.C. and manufacturer's recommendations.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."
- B. Include product data for surface metal raceways, multi-outlet assemblies, wireways, and accessories.

## PART 2 - PRODUCTS

### 2.1 SURFACE METAL RACEWAYS

- A. Acceptable Manufacturers
  - 1. Wiremold Series: 200, 500, 700
  - 2. Substitutions: Under provisions of Div. 01.
- B. Description: U.L. approved assembly comprising a metal base and cover to form a raceway designed for surface mounting. Cover removable to allow installation of wires after the base channel is installed.
- C. Finish: Paint to match surroundings.
- D. Fittings, Boxes and Extension Rings, Couplings, Elbows, and Connectors: Furnish manufacturer's standard accessories for a complete installation.

### 2.2 MULTI-OUTLET ASSEMBLY

- A. Acceptable Manufacturers:
  - 1. Wiremold -Plugmold Series: #2000 -prewired
  - 2. Substitutions: Under provisions of Div. 01.
- B. Description: U.L. approved assembly comprising surface metal raceway with receptacles.
- C. Receptacles: Convenience receptacle mounted in cover 12 inches on center.
  - 1. Receptacles for Series 2000: Rated 15A, prewired two-circuit 4-wire with insulated grounding conductor.
- D. Finish: Paint to match surroundings.
- E. Receptacle Color: Ivory.
- F. Fittings, Boxes and Extension Rings, Couplings, Elbows and Connectors: Furnish manufacturer's standard accessories for a complete installation.

### 2.3 WIREWAYS

- A. Acceptable Manufacturers:
  - 1. General Electric.
  - 2. Square D.
  - 3. Substitutions: Under provisions of Div. 01.
- B. Description: U.L. approved narrow sheet metal enclosure, rectangular in cross section, hinged or removable cover for housing and protecting electric wires and cable and in which conductors are laid in place after the wireway has been installed as a complete system.
- C. General purpose except as indicated. Raintight where installed outside or in damp locations, with knockouts only as required.
- D. Size: As required by NEC Article 376 for the number and size wires indicated. Minimum 6 x 6 inches.

- E. Cover: Hinged or screw type with built-in protection for conductors.
- F. Fittings, Couplings, Elbows, Offsets, End Caps and Connectors: Furnish manufacturer's standard accessories for a complete installation. Fittings shall have removable front covers for installation of wires.
- G. Code gauge, enameled steel with rust inhibiting primer coat. Gray enamel finish except as noted.

#### 2.4 MODULAR TEL-POWER POLES

- A. Wiremold #25DTP-4, or equal. Column height: As required for indicated room. See room finish schedule.
- B. Each pole shall be complete with minimum of two spec-grade duplex receptacles, mounting hardware, entrance fittings, ceiling plate trim and one tel/data outlet. See Section 16741 Telephone/Data system.
- C. Provide additional special outlets as indicated and required.
- D. Power Connections: Minimum of 10'-0" type MC cable from junction box to allow pole to be moved
- E. Tel/Data Connection: Cable with sufficient slack to move pole 10'-0".

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Exposed wiring shall not be installed in finished areas except as specifically indicated. Where existing conditions require building wiring to be exposed, use surface metal raceways. Obtain approval from the Architect prior to installing surface wiring.
- B. Install products in accordance with manufacturer's instructions.
- C. Mount multi-outlet assembly up as indicated on Drawings. Where shown above counters, mount directly above backsplash except as noted. Provide blank sections within 12 inches of sinks. Within 6'-0" of sink, use GFCI type receptacles or protect with GFCI type branch breaker.
- D. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.
- E. Maintain grounding continuity between raceway components to provide a continuous grounding path. Ground and bond under provisions of Section 260170.
- F. Support wireways as approved with supports located at every splice and fitting and at intervals not to exceed five feet.

END OF SECTION 260112

## SECTION 260123 - WIRE AND CABLE

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Building wire and cable.
- B. Metal clad cable.

#### 1.2 RELATED SECTIONS

- A. Section 260010: Basic Electrical Requirements.
- B. Section 260111: Conduit.
- C. Section 260112: Surface Raceways.
- D. Section 260130: Boxes.
- E. Section 260195: Electrical Identification.

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.

#### 1.4 DESIGN REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.
- C. Conductor Sizes Shown Are Based on Copper.
- D. Manufacturer's name, wire size and insulation type shall be clearly marked on the insulation or jacket.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."
- B. Include MC manufacturer's specification sheets indicating construction, diameter, ampacity and
- C. bending radius.

## 1.6 PROJECT CONDITIONS

- A. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet project conditions.
- B. Where wire and cable routing is not shown, and destination or circuit number only is indicated, determine exact routing and lengths required.

## 1.7 COORDINATION

- A. Locate such that outlets are readily accessible.
- B. Determine required separation between cable and other work.
- C. Determine cable routing to avoid interference with other work.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. General Cable.
- B. Triangle PWC, Inc.
- C. Superior Essex Inc.
- D. Southwire Company.
- E. Allied Wire & Cable.
- F. Cerro Wire.
- G. AFC Cable Systems.
- H. Encore Wire Corporation.
- I. United Copper Industries.

### 2.2 WIRE AND CABLE

- A. Description: Single conductor insulated wire.
- B. Conductors: Copper.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation: ANSI/NFPA 70 (N.E.C.), Type THHN/THWN, XHHW, rated 90 degrees C.

### 2.3 METAL CLAD CABLE

- A. Description: ANSI/NFPA 70 (N.E.C.), Type MC with separate insulated ground.



- B. Conductor: Copper, maximum # 10 AWG.
- C. Insulation Voltage Rating: 600 volts.
- D. Insulation Temperature Rating: 90°C.
- E. Armor Material: Steel or Aluminum.
- F. Armor Design: Interlocked Metal Armor
- G. Jacket: None

#### 2.4 WIRING CONNECTORS

- A. Use the Following Types As Herein Specified:
  - 1. Split bolt connectors.
  - 2. Solderless pressure connectors.
  - 3. Spring wire connectors.
  - 4. Compression connectors.
  - 5. Insulation piercing connectors.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

#### 3.2 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

#### 3.3 WIRING METHODS

- A. Concealed Dry Interior Locations: Use only wire Type THHN/THWN, XHHW insulation, in raceway or metal clad cable.
- B. Accessible Dry Interior Locations (such as above acoustical ceilings): Use only wire Type THHN/THWN, XHHW insulation, in raceway or metal clad cable.
- C. Exposed Dry Interior Locations:
  - 1. Use exposed wiring only where specifically indicated.
  - 2. Use only building wire Type THHN/THWN, XHHW insulation, in raceway.
- D. Wet or Damp Interior Locations: Use only building wire Type THHN/THWN, XHHW, XHHW-2 insulation, in raceway.
- E. Exterior Locations: Use only building wire Type THHN/THWN, XHHW, XHHW-2 insulation, in raceway.

- F. Underground Installations: Use only building wire Type THHN/THWN, XHHW or XHHW-2 insulation installed in raceway.
- G. Panel Feeders: Use only building wire Type THHN/THWN, XHHW and XHHW-2 insulation, in raceway.
- H. Use other wiring methods only as specifically indicated on Drawings.

### 3.4 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Except as otherwise specifically noted, all wiring throughout the building, including each of the systems specified, shall be enclosed in raceways.
- C. In general, all wire in raceways and cable shall be concealed above ceilings and within finished walls, securely supported in accordance with code requirements. Wiring in areas with no finished ceilings (exposed construction) shall be raceways exposed overhead, but run along structures such that raceways have minimum visibility and such that all raceways are parallel or perpendicular to joists, columns or beams and concealed in walls.
- D. Use solid conductor for feeders and branch circuits #10 AWG and smaller. At contractors option stranded conductors for #10 AWG and smaller shall be permitted as long as vinyl insulated support crimp-on fork terminals are use for all screw head terminations. Barrel lugs and screw activated compression clamps on back wired devices shall not require crimp-on terminals.
- E. Use stranded conductor for feeders and branch circuits #8 AWG and larger.
- F. Use stranded conductors for control circuits.
- G. Minimum Size Conductors for Power and Lighting Circuits #12 AWG Except as Follows:
  1. Minimum #10 AWG for 120 volt circuits more than 100 feet long.
  2. Minimum #10 AWG for 277 volt circuits more than 230 feet long.
  3. Sizes shall be not less than indicated.
  4. Note: Wire sizes indicated on drawings and schedules are minimum requirements and shall be adjusted to meet the above criteria.
- H. Use conductor not smaller than #14 AWG for control circuits with fusing sized accordingly.
- I. Pull all conductors into raceway at same time.
- J. Use suitable wire pulling lubricant for building wire #4 AWG and larger.
- K. Support cables above accessible ceiling, using spring metal clips or approved cable ties to support cables from structure. Do not support from ceiling suspension system. Do not rest cable on ceiling panels. Do not drape over ductwork or between bar joists. Wiring shall not be run diagonally and shall be cabled neatly.
- L. Use approved cable fittings and connectors.
- M. Neatly train and lace wiring inside boxes, equipment, and panelboards.

- N. Clean conductor surfaces before installing lugs and connectors.
- O. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- P. Use split bolt connectors, insulation piercing connectors or U.L. approved insulated connectors for copper conductor splices and taps, #6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- Q. Use solderless pressure connectors with insulating covers for copper conductor splices and taps, #8 AWG and smaller.
- R. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, 10 AWG and smaller.
- S. Wiring in sleeves passing through fire-rated barriers shall be sealed/filled with approved material to maintain the fire rating.

### 3.5 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 260195.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

### 3.6 FIELD QUALITY CONTROL

- A. Inspect wire and cable for physical damage and proper connection.
- B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- C. Verify continuity of each branch circuit conductor.
- D. Verify proper operation of each circuit.

END OF SECTION 260123

## SECTION 260130 - BOXES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Wall and Ceiling Outlet Boxes.
- B. Pull and Junction Boxes.
- C. Hinged Cover Cabinet Enclosures.
- D. Terminal Blocks and Accessories.

#### 1.2 RELATED SECTIONS

- A. Division 07 Section 078413 "Through Penetration Firestop Systems."
- B. Division 26 Section 260010 "Basic Electrical Requirements."
- C. Division 26 Section 260111 "Conduit."
- D. Division 26 Section 260141 "Wiring Devices."
- E. Division 26 Section 260170 "Grounding and Bonding."
- F. Division 26 Section 260180 "Equipment Wiring."

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.

#### 1.4 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 for "Submittal Procedures".
- B. Include product data for boxes larger than 12x12x6 inches and boxes with hinged covers.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Section 017000.
- B. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches and boxes used for panel feeders.

#### 1.6 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.
- C. Size per N.E.C. Art. 314.

#### 1.7 PROJECT CONDITIONS

- A. Verify field measurements are as shown on Drawings.
- B. Verify locations of wall boxes and outlets in offices and work areas prior to rough-in.
- C. Electrical boxes are shown on Drawings in approximate locations unless dimensioned. Install at location required for box to serve intended purpose.
- D. Generally pull boxes are not shown on Drawings. Provide as required.

#### 1.8 COORDINATION

- A. Locate such that outlets are readily accessible and does not interference with other work.
- B. Provide for access panel where required.

### PART 2 - PRODUCTS

#### 2.1 OUTLET BOXES

- A. Sheet Metal Outlet Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
  - 1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 1/2 inch male fixture studs where required.
  - 2. Concrete Ceiling Boxes: Concrete type, three and four inch deep or depth as to coordinate with concrete slab.
  - 3. Single Wall Type: Minimum size, four inch square by 1-1/2 inch deep, except as noted. Provide dry wall plaster rings raised as required to insure flush finish mounting.
  - 4. Ganged Wall Type: Minimum depth 3 inches except as noted, ganged as required under common plate to contain device shown.
- B. Cast Boxes: Type FS shallow or FD deep, aluminum or cast ferrous alloy.
  - 1. Provide number of threaded hubs as required.
  - 2. Use in all exterior, damp or exposed in mechanical space.
  - 3. Provide gasketed cover and accessories by box manufacturer for complete weatherproofing.

#### 2.2 PULL AND JUNCTION BOXES

- A. Sheet Metal Boxes: Standard type galvanized steel, minimum four inch square or octagon by 2-1/8 inch deep.
  - 1. Sizes up to 12x12x6 inch: Provide screw-type or hinged covers.
  - 2. Sizes greater than 12x12x6 inch: Provide hinged covers.

## 2.3 CABINET ENCLOSURES

- A. Covers: Continuous hinge, held closed by flush latch operable by screwdriver or key. Keyed to match branch circuit panelboard; finish in gray baked enamel.
- B. Boxes: Galvanized steel minimum 12"x12"x6" deep or as noted. Provide 3/4 inch (19 mm) thick plywood backboard painted matte white, for mounting terminal blocks.
- C. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.
- D. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
  - 1. Except where specifically noted, boxes on finished surfaces shall be flush mounted with finished cover plate.
  - 2. Consult Architect prior to installing in finished areas.
- B. Install electrical boxes to maintain headroom and to present neat mechanical appearance.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.
- D. In Non-accessible Ceiling Areas: Install outlet and junction boxes no more than 12 inches from ceiling access panels or from removable recessed luminaires such that they are accessible.
- E. In accessible Ceiling Areas: Install outlet and junction boxes such that they are accessible from ceiling access panels or from removable recessed luminaires.
- F. Install boxes to preserve fire-resistance rating of partitions and other elements, using materials and methods under the provisions of Section 078413.
- G. Align Wall Boxes for Switches, Receptacles, Thermostats, Telephone, and Similar Devices with Each Other as Follows:
  - 1. Horizontally for outlets with same mounting height.
  - 2. Vertically for outlets shown in similar locations with different mounting heights.
- H. Do not install flush mounted boxes back-to-back in walls; provide minimum 6 inch separation. Provide minimum 24 inches separation in acoustic and fire rated walls.
- I. Accurately position flush mounted wall boxes to allow for surface finish thickness.
  - 1. Box shall be flush with finished surface.
  - 2. Use wall box support brackets that span two studs.
  - 3. Single stud support will be allowed only if used with Caddy H series E-Z Mount Brackets or equal product to support side opposite the stud.

- J. Install flush mounting box without damaging wall insulation and vapor barrier or reducing its effectiveness.
- K. Use adjustable steel channel fasteners for hung ceiling outlet box.
- L. Do not fasten boxes to ceiling support wires.
- M. Support boxes independently of conduit, except cast box that is connected to two rigid metal conduits both supported within 12 inches of box.
- N. Use gang box where more than one device is mounted together. Do not use sectional box.
- O. Use 4" square box with plaster ring for single device outlets.
- P. Use cast outlet box in exterior locations exposed to the weather and wet locations.
- Q. Large Pull Boxes: Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
  - 1. Interior Dry Locations: Use hinged covers.
  - 2. Other Locations: Use surface-mounted cast metal box.

### 3.2 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations and sizes of required access doors with Division 08 Section "Access Doors and Frames".
- B. Locate flush mounting box in masonry wall to require cutting of only one masonry unit. Coordinate masonry cutting to achieve neat opening.
- C. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.
- D. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

END OF SECTION 260130

## SECTION 260141 - WIRING DEVICES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Wall Switches.
- B. Wall Dimmers.
- C. Receptacles.
- D. Device Plates.
- E. Lighting Occupancy Sensors.
- F. Relays and Contactors.
- G. Time clocks.

#### 1.2 RELATED SECTIONS

- A. Division 07 Section "Through-Penetration Firestop Systems."
- B. Section 260010: Basic Electrical Requirements.
- C. Section 260130: Boxes.

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.

#### 1.4 SUBMITTALS

- A. Submit Shop Drawings for equipment and component devices in accordance with Division 01 Section "Submittal Procedures".
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
- C. Include documentation showing compliance with UL, Fed. Spec. and NEMA references.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. as suitable for purpose specified and shown.



## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  3. Leviton Mfg. Company Inc. (Leviton).
  4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Cooper; 5351 (single), 5352 (duplex).
  2. Hubbell; HBL5361 (single), CR5352 (duplex).
  3. Leviton; 5891 (single), 5352 (duplex).
  4. Pass & Seymour; 5381 (single), 5352 (duplex)
- B. Device Body:
1. Wall mounted devices shall be Ivory.
  2. Ceiling mounted devices shall be white.

### 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed -through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Will not energize if line and load wiring are reversed.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Cooper; GF20.
  2. Hubbell; GFR5352
  3. Pass & Seymour; 2095

### 2.4 WALL SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
1. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
  2. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
  3. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
  4. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way)
- C. Provide key switches, three-way, four-way switches, etc., as indicated matching the Series listed above. For keyed switches, provide minimum 2 keys per keyed device.
- D. Device Body: Toggle handle type, color: Ivory.

- E. Pilot Light: Neon type #1720-120v red. Separate gang position combined under same plate as switch or separately mounted.

## 2.5 LIGHTING VACANCY/OCCUPANCY SENSORS

- A. Manufacturers:
  - 1. Hubbell H-Moss. Model numbers listed except as noted.
  - 2. Lightolier
  - 3. Light-O-Matic
  - 4. Sensor Switch
  - 5. Leviton
- B. Complete with Faceplates, Color: White except as noted.
- C. Occupancy Sensor - Room Ceilings: Hubbell ATD2000CRP dual technology ceiling mounted sensor with auxiliary isolated relay and photocell.
  - 1. 24 VDC/VAC and halfwave rectified AC
  - 2. Ultrasonic frequency of 40kHz
  - 3. Time delays: automatic and fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode. Set units for 20 minute delay to OFF.
  - 4. Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity (for PIR sensitivity); ultrasonic sensitivity is variable with trimpot
  - 5. Built-in light level sensor works from 10 to 300 footcandles
  - 6. Low voltage, momentary switch input for manual operation
  - 7. Auxiliary isolated relay with N/O and N/C outputs; rated for 1 Amp @ 30 VDC/VAC for use by the Building Automation System.
  - 8. Multi-level, 360° Fresnel lens for superior occupancy detection
  - 9. Control unit (power pack): up to 4 sensors or 3 sensors and 1 Add-A-Relay. Include the Add-A-Relay for use by the Building Automation System.
  - 10. Typical PIR Coverage: 2000 sq.ft.
  - 11. Typical Ultrasonic Coverage: 600 sq.ft.
  - 12. UL and CUL listed; Five year warranty
  - 13. Provide control units (power packs) CU300A, mounting brackets and other hardware as required for a complete working system to cover the areas indicated.
- D. Vacancy/Occupancy Sensor - Wall Switch: Hubbell ATD1277 series Adaptive Dual Technology Ultrasonic and Passive Infrared wall-switch with Manual-Off override button with the following features:
  - 1. Dual 120/277 VAC.
  - 2. Coverage – Use ATD1277H Hard Lens for small spaces up to 300 sq. ft. and ATD1277 for larger areas up to 1000 sq. ft.
  - 3. Compatible with all electronic ballasts.
  - 4. Zero crossing control circuitry.
  - 5. Time out button.
  - 6. Test button
  - 7. Concealed service disconnect air gap switch.
  - 8. Selectable self adjusting time out or fixed four minute.
  - 9. UL listed.
  - 10. Five year warranty.
  - 11. Color: Ivory.
- E. Provide detailed wiring diagrams with submittals.

## 2.6 LED WALL DIMMERS

- A. Manufacturers:
  - 1. Leviton IP710-DLZ (0-10volt) Series except as indicated
  - 2. Lutron
  - 3. Lightolier
  - 4. Lithonia
- B. Plastic with linear slide and ON/OFF button.
- C. 1200VA, 120/277 Volt AC 60Hz, Single-Pole & 3-Way, Illuma-Tech Preset Electro-Mechanical Electronic 0-10VDC Slide Dimmer with LED Locator Light.
- D. Power circuit shall pass through dimmer ON/OFF button to Ballast or LED driver, plus separate pair of 0-10volt low voltage wires to dimming ballast or driver.
- E. Push button switch shall acts as an air-gap switch completely disconnects power to dimming ballast or driver to allow for fixture service.
- F. Power failure recovery shall ensures retention of last setting before power interruption.

## 2.7 STANDARD WALL DIMMERS

- A. Manufacturers:
  - 1. Lutron. Model NOVA-T Series except as indicated.
  - 2. Lightolier
  - 3. Or equal
- B. Plastic with linear slide.
- C. Voltage: 120 volts.
- D. Power Rating: No less than 125% of load shown on Drawings. Minimum rating: 1000 watts.
- E. Device Body & Plate: Ivory.
- F. Multiple Location Standard Dimming: Lutron Symphony Maestro.
  - 1. Full range dimming from 1 to 10 locations.
  - 2. LED light level indicators on master unit.
  - 3. Minimum 1000 watt capacity.
  - 4. Fits standard designer style wallplates.
  - 5. Multiple function switch with fade
    - a. Press side rocker buttons: dim/brighten.
    - b. Tap plate once: Lights adjust smoothly to level set by rocker.
    - c. Tap plate again: Lights adjust smoothly to "off".
    - d. Press & hold: Activates 10 second gradual fade to "off".
    - e. Tap twice: Lights adjust rapidly to full.
- G. Note that dimmers shall be compatible with loads indicated. Where dimmers are shown serving electronic solid state low voltage transformers such as for MR16 Lamps, then provide appropriate amplifier modules for proper operation. Dimmers shown serving LED shall be 0-10 VDC compatible with the specific drivers installed. Locate as indicated or above accessible

ceiling. Wire as required by the manufacturer's installation instructions.

H. Device Body & Plate: Ivory.

## 2.8 WALL PLATES

A. Decorative Cover Plate: Ivory smooth face nylon.

B. Rain-Tight While-in-use Cover Plates: NEMA 3R Clear cover extra deep, Leviton 5966-DCL Series.

C. Utility Area Cover Plates for Surface Mounting: Cadmium plated steel with rounded edges.

## 2.9 RELAYS/ CONTACTORS, AND TIME CLOCK CONTROLS

A. Similar to the following with characteristics as indicated or equal:

B. Control Relays: Allen-Bradley Bulletin "700" Series.

1. 120 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: two.
3. Minimum continuous ampere rating: 5 amps.
4. Enclosure: NEMA-1, except as noted.
5. Electrically held, except as noted.
6. 600 volt rated.
7. For non-lighting low voltage control applications.

C. Lighting Relays/ Contactors: Allen-Bradley Bulletin "500L" Series.

1. 120 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: two.
3. Minimum continuous ampere rating: 125 percent of the connected load, except minimum 20 amps.
4. 600 volt rated.
5. Enclosure: NEMA-1, except as noted.
6. Electrically held, except as noted.
7. Rated for lighting and heating loads.

D. Motor Load Relays/ Contactors: Allen-Bradley Bulletin "500" Series.

1. 120 volt coil as required.
2. Number of poles as indicated or required. Minimum number of poles: three.
3. Horsepower rated for connected motor, except minimum NEMA size 0.
4. 600 volt rated.
5. Enclosure: NEMA-1, except as noted.
6. Electrically held, except as noted.

E. Time Clock Control: Tork Model #DZS200-Series.

1. Digital two channel astronomical with LCD display.
2. 120volt, 240 volt and 277 volt as required to match voltage indicated.
3. 48 events per channel/per week.
4. 16 individual holiday dates.
5. 72 hour memory backup with rechargeable battery.
6. NEMA type III indoor/outdoor enclosure.
7. Contact ratings: 10 amperes at 277 volt.

- F. Photoelectric Control: Tork # model 2101 for 120 volts and model 2104 for 277 volts.
  - 1. Adjustable ON/OFF: ON range from 2 to 50 f/c.
  - 2. Rated 2000 watts tungsten at 120, 240 and 277 volts.
  - 3. Enclosure: Die-cast zinc, gasketed for exterior use.
  - 4. Cell: Cadmium sulfide, 1" diameter.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices and plates vertical and plumb. Boxes shall be flush with finished surface.
- C. Provide matching blank face plate for all unused wall boxes.
- D. Install switches with Off position down.
  - 1. Locate close to door frame on latch side of door, or beyond swing of door where appropriate.
  - 2. Where door frames have side lights, switch shall be either located below side light where a 3'-0" mounting height is possible, or beyond the side light. Coordinate with door frame schedule.
  - 3. Switches indicated in the same area at the same mounting heights shall be ganged together under a common plate.
- E. Install wall dimmers to achieve full rating specified. Do not break off cooling fins. Mount in separate gangs as required.
- F. Install receptacles with grounding pole on top.

END OF SECTION 260141

## SECTION 260170 - GROUNDING AND BONDING

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Equipment grounding conductors.
- B. Bonding.

#### 1.2 RELATED SECTIONS

- A. Section 260010: Basic Electrical Requirements.

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 (N.E.C.) Latest Edition.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Grounding System Resistance: Conform to requirements of ANSI/NFPA 70.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Product Data: None.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 01 Section "Project Management and Coordination".
- B. Accurately record actual locations of grounding electrodes.

### PART 2 - PRODUCTS

#### 2.1 ROD ELECTRODE

- A. Existing.

#### 2.2 WIRE

- A. Material: Copper.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install Products in accordance with manufacturer's instructions.
- B. Equipment Grounding Conductor: Provide separate, 600 volt insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.
- C. Provide and install equipment grounding conductor to each item of electrical equipment.
- D. Grounding and bonding conductors shall be continuous where possible. Where splices are required, provide T & B, or approved equal, compression connectors of approved pattern. Insulate connectors to equivalent thickness of conductors.

END OF SECTION 260170

## SECTION 260180 - EQUIPMENT WIRING

### PART 1 - GENERAL

#### 1.1 WORK INCLUDES

- A. Electrical Connections to Equipment Specified under Other Sections Or Furnished by Owner.
- B. All line voltage wiring including final branch circuit connections to disconnects, motor controllers, Variable Frequency Drives (VFD), Isolation transformers, and motors.
- C. Fused and non-fused disconnect switches for the equipment, except disconnect switches specifically provided with the equipment.
- D. Except as specifically noted, motors, variable frequency drives (VFD), isolation transformers for VFD, magnetic or manual starters and thermal overload protection will be furnished with the equipment for installation under Section 260180.
  - 1. Single pole switches, switch and pilots, and light/fan switches shall be provided and installed under Section 260180. Coordinate with equipment schedules on H&V Drawings.
- E. Temperature Control Wiring: Provided and installed under Division 23 Section "Instrumentation and Controls for HVAC Systems".
- F. Roof Top Equipment: Whether shown or not on the Drawings, provide a weather proof GFCI service receptacle at units per code requirements. For 120 volt, 15 and 20 amp equipment, connect to line side of safety switch. For larger equipment, provide home run to nearest 120 volt, 20A, 1 pole spare breaker. Label and show on as-built drawings.

#### 1.2 RELATED SECTIONS

- A. Division 01 Section "Summary".
- B. Division 08 – "Openings".
- C. Division 11 – "Equipment"
- D. Division 22 – "Plumbing".
- E. Division 23 – "Heating Ventilation and Air Conditioning".
- F. Division 26 Section "Basic Electrical Requirements".

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 (N.E.C.) Latest Edition.
- C. U.L. Standards.



- D. ANSI Standards.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70. (N.E.C.)
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- C. Drawings do not show all required disconnect servicing switches. Furnish and locate as required by N.E.C.
- D. Size fuses and thermal elements per N.E.C. and manufacturer's recommendations.
- E. Connect motors for correct voltage, phase and rotation.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Include disconnect devices, wiring connections and special outlets.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. I-T-E Siemens.
- B. General Electric.
- C. Square D.

#### 2.2 DISCONNECT SWITCHES

- A. Enclosed, heavy-duty type, except as noted with visible blades, Horsepower rated 600-volt and 250-volt ratings as required by the particular circuit.
- B. NEMA-1 enclosure, for dry locations; NEMA-3R rain-tight for exterior locations.
- C. Fuses and ampere rating and number of poles as indicated on Drawings, or as required by the specific equipment.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

#### 3.2 PREPARATION

### EQUIPMENT WIRING

- A. Review equipment submittals prior to installation and electrical rough-in. Verify location, size, and type of connections. Coordinate details of equipment connections with supplier and installer.

### 3.3 INSTALLATION

- A. Use wire and cable with insulation suitable for temperatures encountered in heat-producing equipment, but in no case less than the wire specified under Section 260123, Wire and Cable.
- B. Conduit Connections to Equipment: Dry locations, use flexible conduit. Damp or wet locations, use flexible liquidtight Type UA conduit with approved liquidtight fittings. Maximum length two feet (2').
- C. Install pre-finished cord set where connection with attachment plug is indicated or specified, or use attachment plug with suitable strain-relief clamps.
- D. Provide suitable strain-relief clamps for cord connections to outlet boxes and equipment connection boxes.
- E. Make wiring connections in wiring compartment of prewired equipment in accordance with manufacturer's instructions.
- F. Install disconnect switches, controllers, control stations, temperature switches as indicated or required.

END OF SECTION 260180

## SECTION 260195 - ELECTRICAL IDENTIFICATION

### PART 1 - GENERAL

#### 1.1 WORK INCLUDES

- A. Nameplates and Tape Labels.
- B. Wire and Cable Markers.
- C. Conductor Color Coding.

#### 1.2 RELATED SECTIONS

- A. Division 09 Section – “Painting”.
- B. Section 260010: Basic Electrical Requirements.

#### 1.3 REFERENCES

- A. NFPA 70 (N.E.C.) Latest Edition.

#### 1.4 REQUIREMENTS

- A. Label all new and existing panelboards plus circuits on all spaces of panels, all safety switches, controls, relays, junction boxes, pull boxes, pilot lights, special switches and outlets. Label on panelboards shall include name and circuit number of source.
- B. Nameplates shall identify function of device, space controlled, voltage conditions, fuse size, panel serving switch, as indicated or required without abbreviations. Details shall be as approved.
- C. Conform to requirements of ANSI/NFPA 70. (N.E.C.) Art. 200 for grounded neutral conductor, Art. 210 for branch circuits and art. 250 for grounding (bonding) conductor.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, in accordance with Division 01 Section “Submittal Procedures”.
- B. Only include if details of nameplates, wiring markers and conductor color code are not as specified below.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Nameplates: Engraved three-layer laminated plastic, white letters on a black background.
- B. Junction Box Labels: Hand lettered with indelible black marker. Indicate voltage and circuit.

- C. Wire and Cable Markers: Cloth markers, split sleeve or tubing type.
- D. Fire Alarm Junction Boxes: Paint red.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install nameplates parallel to equipment lines.
- B. Secure nameplates to equipment fronts using screws, or rivets, or adhesive. Secure nameplate to inside face of recessed panelboard doors in finished locations. Secure nameplate to outside face of surface panelboards in unfinished locations.

### 3.2 WIRE IDENTIFICATION

- A. Conductors throughout the building shall be color coded to identify voltage and phases.
  - 1. All metallic bonding conductors - Green.
  - 2. Phase Conductors of 120/208 Volt System: Black, red, blue. Neutral: white.
- B. All circuit conductors of the same color shall be connected to the same ungrounded feeder conductor throughout the installation.
- C. Where Conductors Are Not Available in the Colors Indicated, Due to Size, Prewired Cable, or Other Reason: Install identifying adhesive bands 3/4" wide of colors indicated above around each conductor within six inches (6") and twelve inches (12") of each end and at a maximum of five foot (5') intervals along wireways, at back of panelboards, and wherever conductors are accessible.
- D. Power and Lighting Circuits in Panelboard Gutters, Pull Boxes, Outlet and Junction Boxes, and at Load Connection: Provide wire markers on each conductor and Identify with branch circuit or feeder number.
- E. System Control Wires at Control Panel and Load Connection:
  - 1. Provide wire markers on each conductor and identify with number as indicated on manufacturer's schematic and interconnection diagrams.
  - 2. Fire Alarm System: Follow local Fire Department color code and labeling standards.

END OF SECTION 260195

## SECTION 260470 – PANELBOARDS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Panelboards.
- B. Individually mounted circuit breakers.

#### 1.2 RELATED SECTIONS

- A. Division 01 Section "Submittal Procedures."
- B. Division 06 Section "Rough Carpentry."
- C. Division 09 Section "Painting."
- D. Section 260010: Basic Electrical Requirements.
- E. Section 260170: Grounding and Bonding.

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 (N.E.C.).
- B. Furnish products listed and classified by Underwriters Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- C. Size per Drawings.

#### 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owners' Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."
- B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement, catalog, specification and sizes, panel dimensions, and gutter space.
- C. Include calculations and details of selected components to confirm compliance with the NFPA 70E criteria. Provide completed labels with following details.

1. Include Completed Hazard Warning Labels To Read As Follows:  
! Warning; Arc Flash and Shock Hazard.  
Appropriate PPE Required.  
Failure To Comply Can Result In Death or Injury.  
Refer to NFPA 70E.  
Flash Hazard Boundary: \_\_\_\_inch;  
Flash Hazard at 18 in. : \_\_\_\_Cal/cm<sup>2</sup>  
Category \_\_\_\_; PPE Description \_\_\_\_.  
Clove Class: \_\_\_\_.  
Voltage: Shock Hazard when cover is removed.  
Limited Approach: \_\_\_\_inch.  
Restricted Approach: \_\_\_\_inch.  
Prohibited Approach: \_\_\_\_inch.
2. Located on each panel per NEC Art. 110.16

#### 1.6 SPARE PARTS

- A. Keys: Furnish to Owner 1 key for each panel. All panels shall be keyed alike or to Owners keying system. Keys shall match existing panels.
- B. Fuses: Furnish to Owner three (3) spare fuses for each circuit and each device specified with fuses. Maximum of six (6) spare fuses of each type and rating installed.
- C. Fuse Pullers: Furnish one fuse puller to Owner.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURES - PANELBOARDS

- A. General Electric.
- B. Eaton.
- C. Siemens.
- D. Schneider Electric (Square D).

#### 2.2 PANELBOARDS RATED 400AMPERE AND LESS

- A. Circuit breaker type with mains and circuits as indicated on the Drawings and all designed for three phase, four wire, solid neutral, 60 cycle service rated for 120/208 volt service as scheduled.
- B. Enclosure: NEMA Type 1 except as noted. Code gauge galvanized steel boxes and enameled steel fronts sized for 6" minimum side, top and bottom gutters, or greater as required by NEC.
- C. Flush or surface mounting as indicated by the panel schedule, concealed hinge and flush lock all keyed alike.
- D. Bus: Copper ratings as scheduled on Drawings. Provide sub-feed and feed-through lugs as required. Lugs designed for use for both copper and aluminum conductors. Sub-feed shall

signify that lugs are tapped ahead of buses and feed-through shall signify that lugs are tapped on load side of the main and buses.

- E. Neutral Bar: Copper, full size insulated from the cabinet and provided with lugs for each branch circuit space in the panel.
- F. Bonding strap securely attached to the cabinet with lugs as required to receive the bonding conductors indicated and specified.
- G. Unless indicated otherwise on the drawing schedules, Minimum Integrated Short Circuit Rating:
  - 1. 10,000 amperes rms symmetrical at 240 volt for 120/208v panels served by a dry type transformer rated 75 KVA or less.
  - 2. 22,000 amperes rms symmetrical at 240 volt for 120/208v panels served by a dry type transformer rated greater than 75 KVA.
- H. Molded Case Circuit Breakers: Toggle type thermal-magnetic, quick-make, quick-break, with silver-plated contacts, bolt-in type, and with common trip for multiple circuits. Breakers shall have a nominal thickness of 1" per pole. Provide circuit breakers UL listed as Type SWD for switching lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where indicated.

### 2.3 INDIVIDUALLY MOUNTED CIRCUIT BREAKERS

- A. Circuit Breakers as Main: As specified above for Main Panelboard: U.L. labeled for use as service entrance equipment.
- B. Molded Case Circuit Breakers: As specified above for Panelboards.
- C. Enclosure: NEMA Type 1 general purpose except as noted.
- D. Flush or surface mounted as indicated.

### 2.4 ACCEPTABLE MANUFACTURERS - FUSES

- A. Buss or equal.

### 2.5 FUSES

- A. Fuses 600 Amperes and Less: Dual element, current limiting, time delay, 600 volt, UL Class J.
- B. Fuses 601 Amperes and Larger: Current limiting, time delay 600volt, UL Class L.
- C. Interrupting Rating: 200,000 rms amperes.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install panelboards plumb and properly secured. Recessed panels shall be flush with wall finishes.

- B. Height: Per N.E.C.
- C. Provide filler plates for unused spaces in panelboards.
- D. Provide typed directory completely filled-in indicating outlets, fixtures, devices, and locations served by the circuit. Revise directory to reflect circuiting changes required to balance phase loads.
- E. Stub 4 empty one inch conduits to accessible location above, ceiling and below floor, from each recessed panelboard that has accessible ceilings above and/or below the panel.
- F. Provide completed Hazard Warning Labels mounted on each panel.
- G. Finish painting of flush panelboards and individually mounted breakers shall be as specified in Division 09 Section "Painting".
- H. Properly support backboards, and panels. Coordinate with Division 06 Section "Rough Carpentry", to provide blocking as required.
- I. Properly support backboards, and panels. At non structural walls, provide separate support system for panelboards and equipment. Use UNISTRUT P5000 channels or equal. Length and spacing to form rigid separate wall. In other areas, coordinate with Division 06 Section "Rough Carpentry", to provide blocking as required.

### 3.2 FIELD QUALITY CONTROL

- A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.
- B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

### 3.3 PANELBOARD SCHEDULE

- A. See Drawings.

END OF SECTION 260470



## SECTION 260510 – LUMINAIRES

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. **The Owner will furnish all luminaires.**
- B. Interior and exterior luminaires and accessories.
- C. Ballasts.
- D. Lamps.
- E. Additional wiring methods for luminaires.

#### 1.2 RELATED SECTIONS

- A. Section 260010: Basic Electrical Requirements.
- B. Section 260111: Conduit.
- C. Section 260123: Wire and Cable.
- D. Section 260130: Boxes.
- E. Section 260170: Grounding and Bonding.
- F. Section 260141: Wiring Devices. (for self contained local controls)

#### 1.3 ALLOWANCES

- A. Cash Allowances: None.

#### 1.4 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 N.E.C. Latest Edition.
- C. U.L. Standards.
- D. ANSI/NFPA 101 - Life Safety Code.

#### 1.5 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70 (N.E.C.).
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.

#### 1.6 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures".
- B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
- C. Product Data: Provide dimensions, ratings, performance data and total input watts.
- D. Product Data - Ballast: Provide ratings and performance data for State of Maine High Efficiency Schools Program.
- E. Product Data - Lamps: Provide ratings and performance data for State of Maine High Efficiency Schools Program.
- F. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site. Inspect for damage.
- B. Protect from moisture, corrosion and entrance of debris by storing above grade. Provide appropriate covering.

#### 1.8 SPARES

- A. Provide two of each louver type.
- B. Provide two of each plastic lens type.
- C. Provide replacement lamps for each lamp type installed as follows:
  1. 10% OR 100 lamps where 1000 or more lamps of one type are installed.
  2. Minimum of 2 lamps for each type.
- D. Provide replacement ballasts for each ballast type installed as follows:
  1. 1% of total ballasts per type installed.
  2. Minimum of 2 ballasts for each type installed.

#### 1.9 PROJECT CONDITIONS

- A. Wiring to fixtures as shown on Drawings is diagrammatic only and is intended to show circuit and switching arrangements. Fixtures shall not be used as raceways except as specifically allowed by N.E.C. Art 410.
- B. Where panel designation and circuit numbers are shown with no homerun symbol, wiring to same circuits may share same homerun to panel. See voltage drop and distance restrictions in Section 260010.

### PART 2 - PRODUCTS

#### 2.1 LUMINAIRES

- A. Furnish products as specified in schedule on Drawings.
- B. All fixtures shall be approved by Underwriters' Laboratories, Inc., and bear Underwriters' labels.
- C. In addition to the manufacturers listed on the Drawings, fixtures with equivalent details and matching characteristics as provided by manufacturers listed below shall be considered for approval after review of Shop Drawings.
- D. Manufacturers:
 

Halo	Exceline	Insight Lighting	Moldcast
Columbia	Holophane	Keystone	Peerless
Exceline	Hubble	KIM	QL
Cooper	ICE (ICON)	Lightolier	Spaulding
Daybrite	Keene	Litecontrol	SPI
Delta	Benjamin	Lithonia	Winona
- E. Ballast: Provide ballast suitable for lamp specified.
- F. Lamps: All lamps shall be furnished and installed in each fixture.
- G. Poles: Provide poles with each site/roadway luminaire. Height, round, square, aluminum or enamel steel as indicated on the schedule. Color to match luminaire. Handhole capable of accepting a duplex receptacle.

2.2 BALLASTS: Rated 120/277 volts or as noted.

- A. Ballast Manufacturers:
  1. Valmont.
  2. Osram/Sylvania.
  3. Universal Lighting Technologies.
  4. Magnetek.
  5. Jefferson.
  6. Advance.
- B. T8 and T5HO linear lamp Fluorescent Ballast:
  1. Fully electronic 25,000 Hz programmed start, two, three and four lamp type. Quantities to allow switching as indicated on plans. Provide only rapid start lamps which are specifically designed to operate properly on instant start electronic ballasts.
  2. Ballasts for all recessed fixtures shall be of the very low heat (VLH) design.
  3. Total harmonic distortion shall be less than 15%.
  4. Ballast Factor Shall be Normal (minimum 0.88).
  5. Where fixtures run end to end, or are within the standard 11 foot ballast whip distance, then efforts shall be made to utilize as many four lamp ballasts as possible (driving four lamps). In all cases, ballasts shall be installed to drive the exact number of lamps they are designed for, Example - one lamp ballast drives one lamp, two lamp ballast drives two lamps, etc. Installation where this criteria is not followed will not be accepted.
  6. Where fixtures can use 11 foot whips (master and satellite pairs), ballast shall be installed to drive the exact number of lamps indicated and fixture shall be provided with pre-manufactured ballast whips.
  7. Ballast shall be approved for use in "High Efficiency Schools" by the State of Maine.
- C. Fluorescent Dimming Ballast:

1. Equal to Advance Mark 7 (0-10V).
2. Fully electronic 42,000 Hz programmed start, two, three and four lamp type. Quantities to allow control as indicated on plans. Provide proper rapid start lamps which are specifically designed to operate properly on electronic dimming ballasts.
3. Ballast shall have a Class A sound rating.
4. Dimming shall be controlled by a Class 1 or Class 2 low-voltage 0-10V circuit.
5. Ballast shall operate from 50/60 Hz input source of 120V or 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the ballast..
6. Input current shall have Total Harmonic Distortion (THD) of less than 10% when operated at nominal line voltage with primary lamp.
7. Ballast shall be provided with integral protection circuitry to withstand connection of the low voltage control leads to the mains power supply. In this event, ballast shall default to the maximum light output level.
8. Ballast shall tolerate sustained open circuit and short circuit output conditions without damage.
9. Ballast shall control lamp light output from 100% - 3% relative light output for T8 and CFL lamps and 100 - 1% relative light output for T5/HO lamps.
10. Ballast shall ignite the lamps at any light output setting selected without first going to another output setting.
11. Ballast shall contain auto restart circuitry in order to restart lamps without resetting power.
12. Ballast shall be approved for use in "High Efficiency Schools" by the State of Maine.

D. LED Dimming Driver:

1. Equal to Advance Xitanium (0-10V).
2. Fully electronic designed to operate properly on the LED sources indicated. Coordinate wit LED manufacturer for compatibility.
3. Drivers shall have a Class A sound rating.
4. Dimming shall be controlled by a Class 1 or Class 2 low-voltage 0-10V circuit.
5. Driver shall operate LEDs at a frequency of 60 Hz.
6. Drivers shall operate from 50/60 Hz input source of 120V or 277V with sustained variations of +/- 10% (voltage and frequency) with no damage to the drive..
7. Driver shall have a Power Factor greater than 90% and the input current shall have Total Harmonic Distortion (THD) of less than 20%.
8. Driver shall tolerate sustained open circuit and short circuit output conditions without damage and without need for external fuses or trip devices.
9. Driver shall have a minimum operating temperature of -40C (-40F).

E. High Intensity Discharge (HID) Ballast:

1. High Intensity Discharge Fixtures: All rated for multiple volt operation, connected as indicated in the schedule.
  - a. Metal Halide Fixtures: CWA or Peak lead auto transformer type with high power factor rating of 90% or better.
  - b. High Pressure Sodium Fixtures: Constant wattage auto-transformer, high power factor.

## 2.3 FLUORESCENT DIMMING BALLASTS AND CONTROLS

- A. Control Unit: Lutron Linear slide wall control rated to support up to 20 electronic dimming ballast fixture packs.

- B. Dimming Ballast:
  - 1. Lutron 120 or 277 volt Hi-Lume series electronic high frequency dimming packs.
  - 2. Designed for smooth dimming of up to 40 F40T12 and F30T12 full wattage lamps. Use only full wattage non-energy saving lamps wherever dimming ballasts are indicated.
  - 3. Furnish dimming ballasts in specified luminaires as indicated in the fixture schedule.
  - 4. Use ballast selected by dimming system manufacturer as suitable for operation with control unit.

## 2.4 LAMPS

- A. Lamp Manufacturers:
  - 1. Sylvania/Osram.
  - 2. Philips.
  - 3. Venture Lighting International.
  - 4. General Electric.
- B. Fluorescent Lamps: T8 (2900 lumen) & T5HO (5000 lumen) as scheduled, Energy saving 3500K, 85 CRI, designed to operate properly when driven by ballasts indicated on the schedule and ballasts as specified herein.
- C. T5 Biax/Dulux fluorescent Lamps: 40W Energy saving 3500K, 3150 lumen, minimum 82 CRI, as scheduled, designed to operate properly when driven by program rapid start ballast. 39W Energy saving 3500K, 2900 lumen, 82 CRI, as scheduled, designed to operate properly when driven by program rapid start ballast.
- D. All Lamps shall be low mercury and non-hazardous, and shall pass the EPAs Toxicity Characteristic Leaching Procedure (TCLP) for the purpose of disposal.
- E. Incandescent Lamps: Rated 130 volt.
- F. High Intensity Discharge Lamps: Supplied as indicated.
- G. Provide lamp types specified for luminaire.
- H. For fluorescent lamps operated by a dimming ballast: Properly burn-in the lamp before installation in the fixture (burn in time shall be 100hours).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Fixtures: Complete with 660 watt sockets, wiring, ballasts, stems, hangers, fittings, end plates, pendant feeds, aircraft cable, etc.
- B. Install in accordance with manufacturer's instructions.
- C. Suspended Luminaires.
  - 1. Pendants:
    - a. 1/2" rigid conduit stems, painted to match fixture, with swivel mounts.
    - b. Where indicated provide aircraft cable suspension. Feed end shall have canopy

- with feed grommet and white coiled cord wrapped around cable. Stretch coil making 1" gaps.
- c. Provide pendant length required to suspend luminaire at indicated height. Cut or lengthened to give mounting heights as indicated and required.
  - d. Where fixtures are specifically indicated to be chain mounted, provide wire hook chain set & jack chains cut to length as required to suspend luminaire at indicated height. Use MC cable supported by cable ties from fixture to junction box mounted in structure above each fixture.
  - e. Except as specifically noted, fixtures shall be supported from structural steel. Provide unistrut channels or equal to span between top cord of joists. Supports shall be suitable for fixture weight and seismic forces.
  - f. Pendant suspension details shall be submitted for approval prior to installation.
- D. Provide 12 gauge safety hanger wire supports for all fixtures recessed in ceiling grids of suspended acoustical ceilings. Hangers shall be independent of ceiling framing suspension system and shall extend from fixture housing to structure above. Lighting fixtures weighing less than 56 pounds shall have two hangers, at diagonal corners of fixture (2 locations). Lighting fixtures weighing more than 56 pounds shall have four hangers, one at each corner of fixture (4 locations). Wires shall have no tension (slack) to prevent ceiling distortion. In addition, attach to ceiling framing "T"s as required by code.
- E. Fixtures with one (1) piece 8' channel shall be supported within two feet (2') of each end and fixtures with 4' channel shall be supported within one foot (1') of each end. Fixtures indicated in continuous rows shall have ends bolted together and shall be provided with 4' long lens constructed so the joint between two (2) sections of an 8' fixture appear the same as two (2) 4' fixtures butted together.
- F. Fixtures in sloping ceilings shall have angle face plate for proper orientation of fixture.
- G. Locate recessed ceiling luminaires as indicated on reflected ceiling plan. Fixtures shall have frame and trim details to match the ceiling suspension system furnished. Coordinate details with Acoustical Treatment Section and installation with the Ceiling Installer to assure fixtures are centered on tiles or on joints as required.
- H. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Install spacers where required to allow proper installation of rabbeted (Tegular) ceiling tiles. Secure to prevent movement.
- I. Install clips to secure recessed luminaires in place. Install recessed luminaires to permit removal from below.
- J. Install recessed luminaires using accessories and firestopping materials to meet regulatory requirements for fire rating.
- K. Install wall mounted luminaires at height as indicated.
- L. Install accessories furnished with each luminaire.
- M. Additional Wiring Methods For Luminaires:
- 1. Refer to Section 260010 - Basic Electrical Requirements: Performance Requirements.
  - 2. Refer to Section 260123 - Wire and Cable: Wiring Methods.

3. Recessed and surface incandescent fixtures: Wiring rated minimum 300E F in metallic conduit where required for Underwriters' approval.
4. Fluorescent Fixtures: Wiring within housings and between fixtures and junction boxes above ceilings shall be Type THHN insulated conductors rated for use at temperatures not lower than 90E C.
5. Wiring From Recessed Fixtures To Junction Boxes: As described in Section 260010 - Basic Electrical Requirements: Performance Requirements.

N. Bond products and metal accessories to branch circuit equipment grounding conductor.

O. Install specified lamps in each luminaire.

### 3.2 INTERFACE WITH OTHER PRODUCTS

A. Locate fixtures to avoid interference with mechanical and structural features.

B. In finished spaces, consult the Architect prior to making adjustment to fixture locations.

### 3.3 FIELD QUALITY CONTROL

A. All fixtures and equipment shall be in first-class condition at time of delivery of building to Owners with all scratches, mars, etc., refinished to factory standards.

B. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

### 3.4 ADJUSTING/CLEANING/RELAMPING

A. Aim and adjust luminaires after dark as directed.

B. Re-lamp luminaires whose lamps have failed at Substantial Completion and six (6) months thereafter.

C. Clean electrical parts to remove conductive and deleterious materials.

D. Remove dirt and debris from enclosure.

E. Clean photometric control surfaces using procedures as recommended by manufacturer.

F. Clean finishes and touch up damage.

G. Where Existing Light Fixtures are Indicated to be Reused: Units shall be cleaned, relamped, reinstalled, and rewired.

### 3.5 SCHEDULE

A. Shown on Drawings.

END OF SECTION 260510

## SECTION 260535 – EMERGENCY LIGHTING EQUIPMENT

### PART 1 - GENERAL

#### 1.1 WORK INCLUDES

- A. **The Owner will furnish all Emergency Lighting Equipment.**
- B. Emergency lighting battery units.
- C. Exit signs.
- D. Emergency fluorescent lamp power supplies.

#### 1.2 RELATED WORK

- A. Section 260010: Basic Electrical Requirements.
- B. Section 260111: Conduit.
- C. Section 260123: Wire and Cable.
- D. Section 260130: Boxes.
- E. Section 260170: Grounding and Bonding.
- F. Section 260510: Luminaires.

#### 1.3 REFERENCES

- A. NEMA Standards.
- B. NFPA 70 (N.E.C.) Latest Edition.
- C. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures.
- D. U.L. Standards.
- E. ANSI Standards.

#### 1.4 DESIGN REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70.(N.E.C.)
- B. Conform to local building code and NFPA 101 for installation requirements.
- C. Furnish products listed and classified by Underwriters Laboratories, Inc. (U.L.) as suitable for purpose specified and shown.
- D. All components of the same manufacturer.



## 1.5 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."
- B. Include all components, electrical characteristics, recommended maintenance procedures and intervals, list of each battery unit and the total device count and load on each unit.
- C. Submit manufacturer's instructions.

## 1.6 WARRANTY

- A. Fully guaranteed for a minimum of three (3) years. Except as noted, batteries shall be warranted for an additional seven (7) years minimum, on a prorated basis with a life expectancy of ten (10) years.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Dual-Lite: Model numbers listed except as noted.
- B. Lightalarms.
- C. Sure-Lites.
- D. Chloride.
- E. Lithonia.
- F. Substitutions: Under provisions of Division 01.

### 2.2 EMERGENCY LIGHTING BATTERY UNITS

- A. Fully automatic, 90 minute operation, compact low-profile design. Injection molded, flame-rated, thermoplastic housing with universal mounting plate. Self-contained lamp and battery package.
  - 1. 120/277 VAC operation.
  - 2. Maintenance-free lead acid battery, 10 year warranty (5 years full, 5 years pro-rata).
  - 3. Two 7.2-watt, 6-volt incandescent sealed-beam lamps.
  - 4. Fully-automatic solid state electronics.
  - 5. Integral test switch.
  - 6. Built-in protection: AC lockout, transformer isolation, low battery voltage disconnect, brownout protection and 15 minute retransfer delay.
  - 7. LED indicators for "Service Alert" and "Operating Status" and visual faults indicators for battery, charger, transfer and lamp faults.
  - 8. Manual Tests: Test switch allows a programmable 1, 5, 30 or 60 minute system check at any time.
  - 9. UL924 Listed (emergency Lighting)
  - 10. Dual-Lite: EZ-2 Series.

- B. Batteries: Sufficient capacity to supply and maintain at not less than 87-1/2 percent of system voltage the total lamp load indicated for a period of time as required by latest edition of NEC,(90 minutes minimum). Initially oversize to meet this criteria over battery's entire life.

## 2.3 EXIT SIGNS

- A. Universal LED type self-powered, complete with ceiling, side wall brackets and arrows and faces as indicated. Brown out, low voltage disconnect, test switch, power indicator.
- B. Precision-molded thermoplastic construction white face and red letters.
- C. Red LED's smooth look and no visible LED dots. Less than 3Watts input power.
- D. Nickel Cadmium Battery with 15 year pro rated warranty.
- E. Dual-Lite LX Series.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install units plumb and level.
- B. Aim directional lamp heads to maximize light in egress paths and as directed.
- C. AC Wiring to Exit Lights: In separate conduit, or MC cable with ground.
- D. Exit Sign Mounting: Generally mount directly above and centered over the doorway opening, on the wall where possible, or mounted from the ceiling when wall mounting is not possible. End wall mounted where required, up 7'-6" AFF. The intent is to locate signs to allow for maximum visibility. Consult Architect before installation, if in question.

END OF SECTION 260535

## SECTION 260721 – FIRE ALARM SYSTEMS

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Allowance: Under this section, carry the sum of \$1,000.00 (One thousand Dollars) for work which may be required above and beyond what is defined in Division 26 for additional work defined as a result of the Meeting and Vendor presentation with the Fire Department and other work as may be directed by the fire department and as required. Refer to Section 260010. The contract will be adjusted by an add or deduct change order for the differential, based on the net difference without markup after receipt of bills upon completion of work.
- B. Complete Addressable Fire Alarm System including but not limited to:
  - 1. Equipment, materials, labor, installation, connection, programming, testing, training and performance of all operations of the intelligent reporting fire alarm system as indicated on the drawings and as herein specified.
  - 2. Alarm initiating devices, alarm notification appliances, fire alarm control panel (FACP), auxiliary control devices, annunciators, and wiring.
  - 3. Gamewell master box to report Fire alarm events to the fire department.

#### 1.2 RELATED SECTIONS

- A. Section 260010 - Basic Electrical Requirements.

#### 1.3 REFERENCES

- A. NFPA 70 (N.E.C.) latest edition.
- B. U.L. Standards.
- C. FM Factory Mutual
- D. NFPA 72 National Fire Alarm Code.
- E. ADA - Americans with Disabilities Act.
- F. NFPA 101 - Life Safety Code.
- G. Local and State Codes.
- H. Portland Fire Department - Rules & Regulations for the Installation of Fire Alarm Systems.

#### 1.4 PERFORMANCE REQUIREMENTS

- A. Conform to requirements of NFPA 70. (N.E.C.), specifically Art 760.
- B. Conform to requirements of the National Fire Protection Association, Standards NFPA 72, NFPA 101 and also all applicable Federal, State and local codes.

- C. All requirements of the Authority Having Jurisdiction (AHJ).
  - D. All components of the same manufacturer, FM approved and listed by Underwriters' Laboratories, Inc., and so labeled.
  - E. Furnish products listed and classified by Underwriters' Laboratories, Inc. (U.L.) as suitable for purpose specified and shown. The fire alarm control panel, network interface and all transponders shall meet the modular labeling requirements of U.L. Each subassembly, including all printed circuits, shall include U.L. modular labels.
  - F. Include all necessary software, programming and the selection of the proper type and quantities of the system components to assure a complete, operational, and Code Compliant System.
  - G. System shall be completely field programmable.
    - 1. Provide the Owner with all required components, interfaces and passwords to allow them full access to the programming features. Provide minimum of 8 hours on site training on programming features.
    - 2. Provide all hardware, software, programming tools, and documentation necessary to allow modifying the fire alarm network on site. Modifications include addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices and zones.
    - 3. The system structure and software shall place no limit on the type and extent of ON-SITE software modifications. Software modification shall not require power shut down of system and shall not cause loss of system fire protection while making modifications.
  - H. Special Programmable Features:
    - 1. HVAC units: Interface shall be field programmable to allow activation on general alarm and/or on selective zoning of local detectors. Set initially to shut down on general alarm, plus send status signal to the Energy Management/Temperature Control system (ATC) provided under Section 15975 - Automatic Temperature Controls. For all HVAC equipment that is required to be shut down upon a fire alarm condition, ensure that fire alarm shutdown of equipment is wired through input contacts within the starter enclosure. Upon receipt of a signal from the building's fire alarm system, power to the load side of the starter shall be turned off. Circuitry shall be provided to ensure that power is off whether the starter is in the "AUTO", "HAND" or "BYPASS" mode. If this feature is not available from the starter manufacturer, division 15 shall be responsible for providing a contactor on the line side of the starter to accomplish the same function. The contactor shall meet the requirements specified under this division.
  - I. The drawings do not show all details of the Fire Alarm System. It shall be the responsibility of the authorized supplier/installer to provide a fully operational code compliant system.
  - J. Coordinate with and obtain approval from the local Fire Chief (AHJ), prior to the Shop Drawing submittal. See Item Submittals.
- 1.5 SYSTEM DESCRIPTION
- A. Fire Alarm System: Addressable automatic and manual initiating, intelligent reporting, microprocessor controlled fire detection and audible and visual fire alarm system with network communications capabilities.

- B. An active/interactive type system where each FACP is repetitively scanned, causing a signal to be transmitted to the local fire alarm control panel node indicating that the FACP and its associated initiating devices and notification appliance circuit wiring is functional. Loss of this signal at the local FACP shall result in a trouble indication on both the FACP display and at the network display.
- C. System Performance and Supervision:
1. Alarm, trouble and supervisory signals from all intelligent reporting devices: Encoded on NFPA style 4 (Class B) signaling line circuits (SLC).
  2. Initiating device circuits (IDC): Wired class A NFPA Style D as part of an addressable device connected by the SCL circuit (end of line returns to the panel using a separate path).
  3. Notification appliance circuits (NAC): Wired class B NFPA Style Y.
  4. Digital electronic signals: Employ check digits or multiple polling.
  5. Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode.
  6. Occurrence of single ground or open condition in the initiating circuit does not disable any device on that circuit.
  7. Occurrence of single ground or open condition on alarm initiating or signaling circuits does not disable that circuit from transmitting in ALARM.
  8. Component or power supply failure places system in TROUBLE mode.
  9. Alarm signals arriving at the main FACP shall not be lost following a primary power failure until the alarm signal is processed and recorded.
  10. Batteries: Under or over battery voltage, shorted or disconnected battery supply places system in TROUBLE mode.
  11. FACP devices are to consist of low current, solid-state integrated circuits, and shall be powered locally from a primary power and standby power source.
  12. Power for initiating devices and notification appliances must be from the main fire alarm control panel, the FACP to which they are connected or to a Field Charging Power Supply (FCPS).
  13. Notification appliance circuits shall have 25% spare capacity.
- D. Alarm Sequence of Operation: Actuation of manual fire alarm station, automatic initiating device and sprinkler flow switches causes system to enter ALARM, which includes the following operations:
1. Indicate location of device in alarm on the fire alarm control panel for all events.
  2. Activate audio visual devices.
  3. Transmit signals to the fire department.
  4. De-energize 120 volt magnetic door holdbacks. Holdbacks provided under Section 087100 Finish Hardware.
  5. Provide one general alarm signal to Automatic Temperature Controls (ATC) panel, see Section 15975.
  6. Activate all programmed events.
  7. Sound and display throughout the building the fire alarm (audio/visual) signaling devices and the pre-recorded messages as required to evacuate all areas of the building.
  8. See Special Programmable Features for additional requirements.
- E. Alarm Silence: The alarm horns may be silenced, after three (3) minutes, at the associated locked control cabinet. Alarm lights shall remain flashing until system is reset. A subsequent zone alarm shall reactivate the signals.

- F. Alarm Reset: RESET function resets alarm system to NORMAL condition (out of ALARM) if alarm initiating circuits have cleared.
- G. Trouble Sequence of Operation: System trouble, including grounding or open circuit of supervised circuits, or power or system failure causes system to enter TROUBLE mode, including the following operations:
  - 1. Visual and audible trouble alarm by zone at associated control panel.
  - 2. Visual and audible trouble alarm at annunciator panels.
  - 3. Manual ACKNOWLEDGE function (trouble silence switch) at control panel silences audible trouble alarm; visual alarm is displayed until initiating trouble is cleared.
- H. The activation of any system smoke detector shall initiate an Alarm Verification operation whereby the panel resets the activated detector and waits for a second activation. If, after reset, a second alarm is reported from the same or any other smoke detector within one (1) minute the system shall process the alarm. If no second alarm occurs within one minute the system shall resume normal operations. The Alarm Verification shall operate only for smoke detectors. Other activated initiating devices shall be processed immediately.
- I. Zoning: Programmable, initially set up so that each device has a separate and distinct address. Provide labor to change device label as direct by Owner and Fire Department.

## 1.6 QUALIFICATIONS

- A. Fire alarm equipment Manufacturer:
  - 1. Company specializing in manufacturing the products specified in this Section with minimum five years documented experience.
  - 2. Company maintaining engineering and service departments capable of rendering advice regarding installation and final adjustment of the system.
- B. Supplier/Installer (Vendor):
  - 1. Norris Inc, 2257 West Broadway, South Portland, ME 04106
    - a. Melissa Peters
    - b. Tel: 1-800-370-3473 x1104
    - c. Fax: 1-207-879-0540,
    - d. Cell: 1-207-671-9506

## 1.7 SUBMITTALS

- A. Prior to submitting Shop Drawings to the Architect, set up a meeting at the Local Fire Department with a complete submittal package. Meeting shall include the Fire Chief, Assistant Fire Chief, and, System Vendor. Vendor shall present the proposed system to the Fire Department and describe in detail, the operation. Once the fire department is satisfied that the proposed system satisfies their requirement (including locations of ADA required Strobes), then the shop drawings may be submitted to the Architect along with a copy of the minutes of the meeting. Shop drawings will not be reviewed by the Architect without this presentation and minutes of the meeting.
- B. Include floor plans showing all devices, wiring, and connections: Plan layout, connection diagrams and catalog cuts of all components. Use 1" = 20' composite contract drawing for shop drawing purposes and shall be marked-up showing all wiring between devices, number of conductors, and labeling system. Shop drawings will not be reviewed by the Architect without

these drawings.

- C. Include proposed wiring color code and verification that it meets local fire department standards.
- D. Include narrative description of system functions and sequence of operation.
- E. Include catalog cuts of all equipment, devices, annunciator layout, control panel modules, and internal terminal configurations.
- F. Include documentation showing proof of U.L. listing for all system components.
- G. Include System Power Supply Requirements:
  - 1. Total panel supervisory current.
  - 2. Total horn/light signal current.
  - 3. Total auxiliary power.
  - 4. Total smoke detector supervisory and alarm power.
  - 5. Total battery amp-hour calculations.
  - 6. Total power on each Field Charger/Power Supply (FCPS).
  - 7. Voltage drop on each notification circuit (voltage drop at each appliance).
- H. Include all cable types.
- I. Include letter verifying that system has been reviewed and approved by the local Fire Department.
- J. Include second year extended service contract listing services included and costs. The cost of this service contract is included under this section.
- K. Submit manufacturer's instructions.

#### 1.8 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches.
- B. Accurately record actual routing of conduits larger than 1 inch and main wiring trunks.

#### 1.9 OPERATION AND MAINTENANCE DATA

- A. Submit operation and maintenance data.
- B. Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.
- C. Include operating instructions, and maintenance and repair procedures.
- D. Include manufacturer's representative's letter stating that system has been tested and is operational. Use NFPA 72 FIRE ALARM SYSTEM CERTIFICATION and DESCRIPTION form.

## 1.10 EXTRA MATERIALS

- A. Provide two manual pull stations.
- B. Provide two keys of each type.
- C. Provide one smoke detector of each type used on Project.
- D. Provide one heat detector of each type used on Project.
- E. Provide one audio/visual appliance.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Notifier: Addressable system. Model numbers used except as noted.
- B. MASTER BOX - Gamewell - no substitutions.

### 2.2 FIRE ALARM CONTROL PANEL

- A. Fire alarm control panel shall be Notifier Model NFS-320. Provide all necessary modules for a complete operational system as specified herein. Panel shall include a microprocessor based central processing unit (CPU). The FACP shall communicate with and control the following types of equipment used to make up the system: intelligent detectors, addressable modules, transponders, local and remote operator terminals, printers, annunciators, and other system controlled devices.
- B. FACP shall perform the following functions:
  - 1. Supervise and monitor all intelligent/addressable detectors and monitor modules connected to the system for normal, trouble and alarm conditions.
  - 2. Supervise all signaling and notification circuits throughout the facility.
  - 3. Detect the activation of any initiating device and the location of the alarm condition. Operate all notification appliances and auxiliary devices as programmed.
  - 4. Visually and audibly annunciate any trouble, supervisory or alarm, condition on operator's terminal, panel display, and annunciators.
- C. Capacity and General Operation:
  - 1. Each loop capable of expansion to 318 intelligent addressable devices. System capable of 1 loop.
  - 2. FACP shall include a full featured operator interface control and annunciation panel which shall include a backlit Liquid Crystal Display (LCD), individual, color coded system status LED's and an alpha-numeric keypad for field programming and control of the fire alarm system.
  - 3. FACP shall provide the following features:

Block Acknowledge	Printer Interface
Charger rate control	CRT Display Interference
Control-by-time	Non-Alarm Module Reporting
Day/Night Sensitivity	Periodic Detector Test



Device Blink Control	Remote Page
Drift Compensation	Trouble Reminder
NFPA 72, Sensitivity Test Upload/Download to PC Computer	
System Status Reports	Verification Counters
Security Monitor Points	Walk Test
Alarm Verification	Maintenance Alert

D. Central Processing Unit (CPU):

1. FACP shall include a central processing unit. The CPU shall communicate with, monitor, and control all other modules within the control panel. Removal, disconnection or failure of any control panel module shall be detected and reported to the system display by the CPU.
2. Each CPU shall contain and execute all control-by-event interlock for specific local and network action to be taken if an alarm condition is detected by the system. Control-by-event programs shall be held in non-volatile programmable memory, and shall not be lost even if system primary and secondary power failure occurs.
3. The central processing unit shall also provide a real-time clock for time annotation of all system displays. The time-of-day and date shall not be lost if system primary and secondary power supplies fail.

E. Signaling Line Circuits (SLC):

1. The system shall include one SLC circuit. Each SLC interface shall provide power to and communicate with up to 159 intelligent detectors (ionization, photoelectric or thermal) and 159 intelligent modules (monitor or control) for a system capacity of 318 devices. Each SLC loop shall be capable of NFPA 72 Style 4, Style 6, or Style 7 (Class A or B) wiring.
2. The CPU shall receive analog information from all intelligent detectors to be processed to determine whether normal, alarm, pre-alarm, or trouble conditions exist for each detector. The software shall automatically maintain the detector's desired sensitivity level by adjusting for the effects of environmental factors, including the accumulation of dust in each detector. The analog information shall also be used for automatic detector testing and for the automatic determination of detector maintenance requirements.
3. The detector software shall meet NFPA 72, requirements and be certified by UL as a calibrated sensitivity test instrument.
4. The detector software shall allow manual or automatic sensitivity adjustment.

F. Serial Interfaces:

1. The system shall include two serial EIA-232 interfaces. Each interface shall be a means of connecting UL Listed Information Technology Equipment (ITE) peripherals.
2. The system shall include an EIA-485 port for the serial connection of annunciators and remote LCD displays.
3. The EIA-485 interface may be used for network connection to a proprietary receiving unit.

G. Notification Appliance Circuit (NAC) Module:

1. The notification appliance circuit module shall provide four fully supervised Class A or B (NFPA Style Z or Y) notification circuits. An expansion circuit board shall allow expansion to eight circuits per module.
2. The notification circuit capacity shall be 3.0 amperes maximum per circuit and 6.0 amperes maximum per module.
3. The module shall not affect other module circuits in any way during a short circuit condition.

4. The module shall provide eight green ON/OFF LEDs and eight yellow TROUBLE LEDs.
5. The module shall also provide a momentary switch per circuit that may be used to manually turn the particular circuit on or off or to disable the circuit.
6. Each notification circuit shall include a custom label inserted to identify each circuit's location. Labels shall be created using a standard typewriter or wordprocessor.
7. The notification circuit module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal strips shall be UL listed for use with up to 12 AWG wire.
8. Each circuit shall be capable of, through system programming, deactivating upon depression of the signal silence switch.

H. Control Relay Module:

1. The control relay module shall provide four Form-C auxiliary relay circuits rated at 5 amperes, 28 VDC. An expansion circuit board shall allow expansion to eight Form-C relays per module.
2. Each relay circuit shall be capable of being activated (change in state) by any initiating device or from any combination of initiating devices.
3. The expansion module shall provide 8 green ON/OFF LEDs and 8 yellow LEDs (indicates disabled status of the relay).
4. The module shall provide a momentary switch per relay circuit that may be used to manually turn the relay ON/OFF or to disable the relay.
5. Each relay circuit shall include a custom label inserted to identify its location. Labels shall be created using a standard typewriter or wordprocessor.
6. The control relay module shall be provided with removable wiring terminal blocks for ease of installation and service. The terminal blocks shall be UL listed for use with up to 12 AWG wire.

I. Remote Relay Module: Notifier model number ACM-8R

1. Remote relay module with eight Form-C relays per module.

J. Operators Terminal: Provide the following functions in addition to any other functions required for the system:

1. Acknowledge (ACK/STEP) Switch:
  - a. Activation of the control panel Acknowledge switch in response to a single new alarm and/or trouble conditions shall silence the local panel piezo electric signal and change the system alarm or trouble conditions that exist or are detected and reported in the system, depression of this switch shall advance the 80-character LCD display to the next alarm or trouble condition.
    - 1) Depressing the acknowledge switch shall also silence all remote annunciator piezo sounders.
2. Signal Silence Switch: Activation of the signal silence switch shall cause all programmed alarm notification appliances and relays to return to the normal condition after an alarm activation. The selection of notification circuits and relays which are silenceable by this switch shall be fully field programmable within the confines of all applicable standards.
3. System Reset Switch:
  - a. Activation of the system reset switch shall cause all local electronically-latched initiating devices, software zones, output devices and circuits, to return to their normal condition.
  - b. If an alarm condition(s) still exists, or if they occur in the system after system reset switch activation, the system shall then resound the alarm conditions.

4. System Test Switch: Activation of the system test switch shall initiate an automatic test of all intelligent/addressable detectors in the local system. The system test shall activate the electronics in each transmission of the alarm condition from that sensor to the fire alarm control panel. The fire alarm control panel shall interpret the data from each sensor installed in the system. A report summarizing the results of this test shall be displayed automatically on the system LCD and on any CRT's or printers in the system.
5. Alarm Activate (Drill) Switch:
  - a. The Alarm Activate switch shall activate all notification appliance circuits. The drill function shall latch until the panel is silenced or reset. Drill switch shall release all door hold open device.
  - b. The drill switch shall not initiate the following: Signal to central receiving station (fire station) Fan shut down, smoke evacuation, and roof hatches,
6. Lamp Test Switch: Activation of the lamp test switch shall sequentially turn on all LED indicators, system liquid crystal display and local piezo signal, and then automatically return the fire alarm control panel to the previous condition.

K. Field Programming:

1. The system shall be programmable, configurable and expandable in the field without the need for special tools or electronic equipment and shall not require field replacement of electronic integrated circuits.
2. All local FACP node programming shall be accomplished through the FACP keyboard or through the video display terminal.
3. All field defined programs shall be stored in non-volatile memory.
4. The programming function shall be enabled with a password that may be defined specifically for the system when it is installed. Two levels of password protection shall be provided in addition to a key-lock cabinet. One level is used for status level changes such as zone disable or manual ON/OFF commands. A second (higher-level) is used for actual change of program information. Passwords shall be made available to authorized personnel upon system acceptance.

L. Specific System Operations:

1. Smoke Detector Sensitivity Adjust: Means shall be provided for adjusting the sensitivity of any or all addressable intelligent detectors in the FACP node from each system keypad. Sensitivity range shall be within allowed UL limits and have a minimum of nine (9) levels.
2. Alarm Verification: Each of the intelligent addressable detectors in the system may be independently selected and enabled for alarm verification. Each FACP shall keep a count of the number of times each detector has entered the verification cycle. These counters may be displayed and reset by the proper operator commands.
3. System Point Operations:
  - a. All devices in the FACP node may be enabled or disabled through the local keypad.
  - b. Any FACP node output point may be turned on or off from the local system keypad.
4. Point Read: The FACP node shall be able to display the following point status diagnostic functions without the need for peripheral equipment. Each point shall be annunciated for the parameters listed:
  - a. Device Status.
  - b. Device Type.
  - c. Custom Device Label.
  - d. Device Zone Assignments.

- e. View analog detector values.
  - f. All Program Parameters
5. System Status Reports: Upon command from a password-authorized operator of the system, a status report will be generated, and printed, listing all local FACP system status.
  6. System History Recording and Reporting: Each FACP node shall contain a history buffer that shall be capable of storing a minimum of 400 system events. Each local activation will be stored and time and date stamped with the actual time of the activation, until an operator requests that the contents be either displayed or printed. The contents of the history buffer may be manually reviewed, one event at a time, and the actual number of activations may also be displayed and/or printed. The history buffer shall use non-volatile memory.
  7. Automatic Detector Maintenance Alert: Each FACP node shall automatically interrogate each intelligent system detector and shall analyze the detector responses over a period of time. If any intelligent detector in the system responds with a reading that is below or above normal limits, then the system will enter the trouble mode, and the particular intelligent detector will be annunciated on the system display, network display and printed on the optional system printer. This feature shall in no way inhibit the receipt of alarm conditions in the system, nor shall it require any special hardware, special tools or computer expertise to perform.

### 2.3 SYSTEM COMPONENTS - CONVENTIONAL

- A. Horn/Strobes: Combination Audible/Visible signals shall be similar to Wheelock #MT series.
  1. Peak sound output: 90 dBA.
  2. Ability to silence the horn while leaving the visible signal active.
  3. Capable of meeting the candela requirements of ADA.
  4. Polarized to allow electrical supervision.
  5. Candela ratings: Selectable 15, 30, 75, 110, with visual indicator.
  6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
  7. Provide specific unit that allows for Slow Whoop audible signal.
  8. Red face plate with white letters.
- B. Fire Alarm Horn Loudspeakers:
  1. Loudspeakers for Gym area: Wheelock STH-15SR series or equal with 25/70/100 VRMS, 15 watt transformer with 7 position watt/impedance selection switch. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3 m).
  2. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
  3. Approved for Fire Protective Signaling Systems.
  4. Provide a strobe light associated with each unit.
- C. Exterior Fire Alarm Horn Loudspeakers:
  1. Loudspeakers for courtyard area: Wheelock STH-15SR series or equal with 25/70/100 VRMS, 15 watt transformer with 7 position watt/impedance selection switch. Speakers in corridors and public spaces shall produce a nominal sound output of 84 dBA at 10 feet (3 m).
  2. Frequency response shall be a minimum of 400 HZ to 4000 HZ.
  3. Approved for Fire Protective Signaling Systems.
  4. Provide a strobe light associated with each unit.

5. Weatherproof, metal construction.
- D. Strobe lights shall be similar to Wheelock #RSS24MC-WFR and shall meet the requirements of the ADA, UL Standard 1971 and shall meet the following criteria:
1. The maximum pulse duration shall be 2/10 of one second.
  2. Strobe intensity shall meet the requirements of UL 1971.
  3. The flash rate shall meet the requirements of UL 1971.
  4. Where more than one strobe is visible in one location, synchronization shall be required.
  5. Candela ratings: Selectable 15, 30, 75, 110, with visual indicator.
  6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
  7. Red face plate with white letters.
- E. Mini-Horn/Strobes: Combination Audible/Visible signals shall be similar to Wheelock #MT series.
1. Peak sound output: 90 dBA.
  2. Ability to silence the horn while leaving the visible signal active.
  3. Capable of meeting the candela requirements of ADA.
  4. Polarized to allow electrical supervision.
  5. Candela ratings: Selectable 15, 30, 75, 110, with visual indicator.
  6. Set initially as shown on drawings. Where drawings show 15/75, then use a fixed 15/75 or set selection at 75.
  7. Provide specific unit that allows for Slow Whoop audible signal.
  8. Red face plate with white letters.
  9. MINI-Units in small rooms and where indicated: Use lowest sounding level setting.

## 2.4 SYSTEM COMPONENTS - INTELLIGENT

- A. Addressable Devices - General:
1. Addressable devices shall maintain decade (numbered 0 to 15 and 0 to 9) type address switches.
  2. Detectors shall be intelligent (analog) and addressable, and shall connect with two wires to the FACP signaling line circuit.
  3. Addressable smoke and thermal detectors shall provide dual alarm and power/polling LED's. Both LED's shall flash under normal conditions, indicating that the detector is operational and in regular communication with the control panel, and both LED's shall be placed into steady illumination by the control panel, indicating that an alarm condition has been detected. If required, the LED flash shall have the ability to be removed from the system program. An output connection shall also be provided in the base to connect an external remote alarm LED.
  4. Smoke detector sensitivity shall be set in the fire alarm control panel and shall be adjustable in the field through the field programming of the system. Sensitivity may be automatically adjusted by the panel on a time-of-day basis.
  5. Using software in the FACP, detectors shall automatically compensate for dust accumulation and other slow environmental changes that may affect their performance. The detectors shall be listed by UL as meeting the calibrated sensitivity test requirements of NFPA Standard 72, Chapter 7.
  6. The detectors shall be ceiling-mount and shall include a separate twist-lock base with tamper proof feature.
  7. The detectors shall provide a test means whereby they will simulate an alarm condition

and report that condition to the control panel. Such a test may be initiated at the detector itself (by activating a magnetic switch) or initiated remotely on command from the control panel.

8. Detectors shall also store an internal identifying type code that the control panel shall use to identify the type of device (ION, PHOTO, THERMAL).
9. Detectors shall operate in an analog fashion, where the detector simply measures its designed environment variable and transmits an analog value to the FACP based on real-time measured values. The FACP software, not the detector, shall make the alarm/normal decision, thereby allowing the sensitivity of each detector to be set in the FACP program and allowing the system operator to view the current analog value of each detector.
10. Addressable devices shall provide address-setting means using decimal switches and shall also store use to identify the type of device. LED(s) shall be provided that shall flash under normal conditions, indicating that the device is operational and is in regular communication with the control panel.
11. A magnetic test switch shall be provided to test detectors and modules. Detectors shall report an indication of an analog value reaching 100% of the alarm threshold.

B. Addressable Pull Box (Manual Station):

1. Addressable pull boxes shall, on command from the control panel, send data to the panel representing the state of the manual switch and the addressable communication module status. They shall use a key operated test-reset lock, and shall be designed so that after actual emergency operation, they cannot be restored to normal use except by the use of a key.
2. All operated stations shall have a positive, visual indication of operation and utilize a key type reset.
3. Manual stations shall be constructed of Lexan with clearly visible operating instructions provided on the cover. The word FIRE shall appear on the front of the stations in raised letters, 1/75 inches or larger.
4. Stations shall be suitable for surface mounting or semiflush mounting as shown on the plans, and shall be installed not less than 42 inches, nor more than 48 inches above the finished floor.
5. Manual boxes shall be the double action type.

C. Intelligent Photoelectric Smoke Detector: The detectors shall use the photoelectric (light-scattering) principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the analog level of smoke density.

D. Intelligent Thermal Detectors: Thermal detectors shall be intelligent addressable devices rated at 135EF. (58EC.) And have a rate-of-rise element rated at 15EF. (9.4EC.) per minute. It shall connect via two wires to the fire alarm control panel signaling line circuit.

E. Intelligent Duct Smoke Detector:

1. The in-duct smoke detector housing shall accommodate either an intelligent ionization detector or an intelligent photoelectric detector, that provides continuous analog monitoring and alarm verification from the panel. Include sampling tube.
2. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.
3. Whether shown on plans or not, all air handling systems operating at 2000 CFM and above shall have duct mounted smoke detection equipment in accordance with the

requirements of NFPA 90A. See Air Handling Schedules on Mechanical drawings. Provide labeled remote test and indicating stations at the fire alarm control panel. Use Photoelectric type detector with duct housing and relays plus appropriate sampling tubes cut to length (width of duct).

- F. Addressable Dry Contact Monitor Module (FMM): shown on drawings as AMM (Addressable Monitor Module).
1. Addressable monitor modules shall be provided to connect supervised IDC zone of conventional alarm initiating devices (any N.O. dry contact device) to one of the fire alarm control panel SLC loops.
  2. The monitor module shall mount in a 4-inch square, 2-1/8 inch deep electrical box.
  3. The IDC zone may be wire for Style D or Style B operation. An LED shall be provided that shall flash under normal conditions, indicating that the monitor module is operational and in regular communication with the control panel.
- G. Addressable Control Module (FCM): shown on drawings as ARM (Addressable Relay Module)
1. Addressable control module shall be provided to supervise and control the operation of one conventional NACs of compatible, 24 VDC powered, polarized audio/visual notification appliances. For fan shutdown and other auxiliary control functions, the control module may be set to operate as a dry contact relay.
  2. The control module shall mount in a standard 4-inch square, 2-1/8 inch deep electrical box, or to a surface mounted backbox.
  3. The control module NAC may be wired for Style Z or Style Y (Class A/B) with up to 1 amp of inductive A/V signal, or 2 amps of resistive A/V signal operation, or as a dry contact (Form-C) relay. The relay coil shall be magnetically latched to reduce wiring connection requirements, and to ensure that 100% of all auxiliary relay or NACs may be energized at the same time on the same pair of wires.
  4. Audio/visual power shall be provided by a separate supervised power loop from the main fire alarm control panel or from a supervised, UL listed remote power supply.
  5. The control module shall be suitable for pilot duty applications and rated for a minimum of .6 amps at 30 VDC.
- H. Isolator Module:
1. Isolator modules shall be provided to automatically isolate wire-to-wire short circuits on an SLC loop. The isolator module shall limit the number of modules or detectors that may be rendered inoperative by a short circuit fault on the SLC Loop. At least one isolator module shall be provided for each floor or protected zone of the building.
  2. If a wire-to-wire short occurs, the isolator module shall automatically open-circuit (disconnect) the SLC loop. When the short circuit condition is corrected, the isolator module shall automatically reconnect the isolated section.
  3. The isolator module shall not require any address-setting, and its operations shall be totally automatic. It shall not be necessary to replace or reset an isolator module after its normal operation.
  4. The isolator module shall mount in a standard 4-inch deep electrical box or in a surface mounted backbox. It shall provide a single LED that shall flash to indicate that the isolator is operational and shall illuminate steadily to indicate that a short circuit condition has been detected and isolated.
- I. Serially Connected Annunciator Requirements:
1. The annunciator shall communicate to the fire alarm control node or INA via an EIA-485

(multi-drop) two wire communications loop. The FACP node shall support two 6,000 ft. EIA-485 wire runs. Up to 32 annunciators, each configured up to 64 points, may be connected to connections, for a system capacity of 2,048 points of annunciation.

2. An EIA-485 repeater shall be available to extend the EIA-485 wire distance in 3,000 ft. increments. An optional (UL 864 listed) version shall allow the EIA-485 circuit to be transmitted over Fiber optics.
3. Annunciator switches may be programmed for system control such as global acknowledge, global signal silence, global system reset, and on/off control of any control point in the system.
4. An optional module shall be available utilizing annunciator points to drive EIA-485 driven relays. This shall extend the system point capacity by 2,048 remote contacts.

J. LCD Alphanumeric Display Annunciator (within panel):

1. The alphanumeric display annunciator shall be a supervised, back-lit LCD display containing a minimum of 640 characters for alarm annunciation in clear English text.
2. The LCD annunciator shall display all alarm and trouble conditions from either the network node or complete network, via the INA.
3. Up to 32 LCD annunciators may be connected to a specific (terminal node) EIA-485 interface. LCD annunciators shall not reduce the annunciation capacity of the system. Each LCD shall include vital system wide functions such as system acknowledge, silence and reset.
4. Annunciator control switches for system acknowledge, signal silence, drill and reset shall be key enabled. Provide 2 keys for Owner and 2 keys for the Fire Department.

## 2.5 BATTERIES

- A. Sealed lead calcium type capable of operation of the system under supervisory conditions for a minimum of 60 hours after power failure and capable of operating the alarm devices for 15 minutes during the 60 hour period. IF batteries do not fit in control panels, then remotely mount in battery cabinet in nearest storage/mech room.

## 2.6 AUXILIARY DEVICES

- A. Provide and install interface relays with number of poles as required (in no event less than three poles). Relays shall be Allen-Bradley, or approved equal, Bulletin 700, Type "BR" series, 120 volt coil in NEMA I enclosures. Paint enclosure red and mark "Fire Alarm Relay."
- B. Protective Wire Guards: Series G2000. Use for all horns, speaker/horns and speaker/horn light units in the Gymnasiums and locker room areas.
- C. Lexan Protective Covers: Series STI Stopper without local alarm. Use for all pull stations in the Gymnasiums and locker room areas.
- D. Provided two remote relay modules (Notifier ACM-8R).

## 2.7 FIELD CHARGING POWER SUPPLY (FCPS) may also be shown on the drawings as NAPX NOTIFICATION APPLIANCE POWER EXTENDER.

- A. Field Charging Power Supply: The FCPS is a device designed for use as either a remote 24 volt power supply or used to power Notification Appliances.
1. The FCPS shall offer up to 8.0 amps of regulated 24 volt power. It shall include an



- integral charger designed to charge 7.0 amp hour batteries and to support 60 hour standby.
2. The Field Charging Power Supply shall have two input triggers. The input trigger shall be a Notification Appliance Circuit (from the fire alarm control panel) or a relay. Four outputs (two Style Y or Z and two style Y) shall be available for connection to the Notification devices.
  3. The FCPS shall include an attractive surface mount back box.
  4. The Field Charging Power Supply shall include the ability to delay the AC fail delay per NFPA requirements.
  5. The FCPS include power limited circuitry, per 1995 UL standards.
  6. Provide quantity as required to serve devices shown on plans. Locate in mechanical, electrical or storage rooms. Extend circuit from nearest emergency panelboard 120V, 20A, spare breaker. Intent is to distribute the loads to limit wire runs and voltage drop.

## 2.8 RADIO MASTER BOX

- A. RADIO MASTER BOX: Gamewell as approved by the Fire Department. Master fire alarm box shall be of the radio type with all features as required by the Portland Fire Department.

## 2.9 FIRE ALARM WIRE AND CABLE

- A. Fire Alarm Power Branch Circuits: Specified in Section 16123.
- B. Alarm System Wiring Within Building: Minimum size #16 AWG for initiating circuits and #14 AWG for alarm signal circuits, all copper-THWN, except as noted. Non power-limited wiring and exposed wiring shall be in rigid conduit or electrical metallic tubing or flexible metal conduit in accordance with Specifications for locations used, see Section 16123 - Wire and Cable: Wiring Methods. Concealed power limited wiring in dry locations above ceilings, in attic space, in stud walls, except as noted, shall be fire resistant teflon covered cables approved for use in an air plenum for fire alarm system.
  1. Cables shall be properly supported, labeled and tie wrapped.
  2. Complete installation shall meet requirements of NEC Article 760 "Fire Protective Signaling Systems."
  3. Cables shall be separated from any conductors of power or class 1 circuits and shall not enter in same conduits or J-boxes.
- C. SLC Multiplex Communication Loop: Twisted shielded pair sized per manufacturer and installed in conduit.
- D. Voice Speaker and Telephone Circuits: Twisted shielded pair sized per manufacturer.
- E. All wiring shall be per manufacturers recommendations for load and length required.

## 2.10 ENCLOSURES

- A. Control panels shall be housed in UL listed cabinets suitable for surface or semi-flush mounting. Cabinets shall be corrosion protected, given a rust-resistant prime coat, and the manufacturer's standard finish. Mount flush in finished areas. All panel locks shall accept Gamewell, Simplex or FCI key.

## 2.11 BEACON

- A. BEACON: Edwards 48FINR-N5-255WH, red, 25watt flashing beacon 120V, 0.2 amps.

## 2.12 FIREMAN'S KEY BOXES

- A. Fireman's Key Boxes: Knox or Supra - Recessed with tamper switch and high security lock to match Fire Department standards.

# PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install system in accordance with manufacturer's instructions.
- B. Wiring shall be concealed in walls and above ceilings. Wiring in exposed construction shall be enclosed in conduit and run along structural members and painted to match.
- C. Minimum size conduit: 3/4 inch. Refer to above paragraph: FIRE ALARM WIRE AND CABLE.
- D. Install manual station with operating handle 48 inches above floor. Install audible and visual signal devices 80 inches above floor, or 6" below ceiling whichever is lower, except as noted.
- E. Smoke detectors shall not be installed prior to system programming and testing period. If construction is on going during this period, then protect the smoke detectors from contamination and physical damage.
- F. Make conduit and wiring connections to door release devices, sprinkler flow switches, sprinkler valve tamper switches, duct smoke detectors.
- G. Automatic Detector Installation: Per NFPA 72.
- H. Provide nameplates identifying all equipment, junction boxes and controls. Paint all junction boxes red.
- I. Wiring Color Code: See section 16195.
- J. Mount outlet box for electric door holder to withstand 80 pounds pulling force.
- K. All devices and panels shall be flush mounted in finished areas and may be surface mounted in unfinished areas such as storage rooms. Where devices are surface mounted, the back box shall be a cast red box designed to mate with the device for a smooth appearance.
- L. Provide Beacon (red, 25watt flashing beacon) mounted above the MASTER BOX to flash upon the activation of the interior fire protection system.
- M. At master box provide minimum of two ground rods with a "box connecting rod" or a #12 AWG solid copper wire, enclosed in conduit, connect to ground terminal of the Master Box. Resistance of ground connection shall not exceed 25 ohms.

- N. Coordinate with the fire department for connection to the municipal loop.
- O. Wire installation shall be inspected by the fire department. Coordinate and ask for inspections from the fire department.
- P. Key box shall be located recessed in the wall of the exterior of the building as indicated on the plans. Cooperate and coordinate with the security vendor for connection of the intrusion switch. For each key box provide a 1" conduit to above an accessible ceiling space for the intrusion vendor's use.
- Q. Factory Trained, licensed authorized technical representative of the manufacturer of the equipment shall adjust taps after installation to meet code requirements.

### 3.2 MANUFACTURER'S FIELD SERVICES

- A. Provide the services of a Factory Trained, licensed authorized technical representative of the manufacturer of the equipment to supervise the installation and final connections, plus adjusting, programming and all testing of the system required to assure a complete and fully operative facility in accordance with the specifications; and to instruct designated personnel in the operation, adjustment, testing and maintenance of the system. Provide letter certifying results of test.
- B. Include testing at substantial completion, at 6 months after occupancy and again two weeks prior to end of first year warranty. (Total of 3 complete documented tests). Invite the Owner, Architect and Local Fire Department to witness each test.
- C. Include testing of the fire alarm system audio/visual devices to assure that the signals are operating according to the guidelines set by the NFPA 72 and the Americans with Disabilities Act (ADA).
  1. The limitations are as follows: NFPA – “Audible signals intended for operation in the public mode should have a sound level of not less than 75 dBA at 10 feet or more than 130 dBA at the minimum hearing distance from the audible appliance.” ADA – “Audible emergency alarms shall produce a sound that exceeds the prevailing equivalent sound level in the room or space by at least 15 dBA or exceeds any maximum sound level with a duration of 60 seconds by 5 dBA, whichever is louder. Sound levels for alarm signals shall not exceed 120 dBA.”
  2. Test the audio/visual units and make adjustments where required, including setting volume of horns and replacing strobes with proper intensity level. If horns are not adjustable then replace for proper dB level. Submit findings in writing, with areas marked that do not meet criteria after adjustments have been made.

### 3.3 FIELD TEST

- A. Test in accordance with NFPA 72 and local fire department requirements. See Submittals item above.
- B. Test shall include but not be limited to:
  1. Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
  2. Close each sprinkler system flow valve and verify proper supervisory alarm at the FACP.
  3. Verify activation of all flow switches.

4. Open initiating device circuits and verify that the trouble signal actuates.
5. Open signaling line circuits and verify that the trouble signal actuates.
6. Open and short notification appliance circuits and verify that trouble signal actuates.
7. Open and short (wire only) network communications and verify that trouble signals are received at network annunciators or reporting terminals.
8. Ground initiating device circuits and verify response of trouble signals.
9. Ground signaling line circuits and verify response of trouble signals.
10. Ground notification appliance circuits and verify response of trouble signals.
11. Check alert tone and prerecorded voice message to all alarm notification devices.
12. Check installation, supervision, and operation of all intelligent smoke detectors using walk test.
13. Each of the alarm conditions that the system is required to detect shall be introduced on the system. Verify the proper receipt and the proper processing of the signal at the FACP and the correct activation of the control panel points.
14. When the Vendor determines that the system must be equipped with optional features to satisfy this specification, the manufacturer's manual shall be consulted to determine the proper testing procedures. This is intended to address such items as verifying controls performed by individually addressed or grouped devices, sensitivity monitoring, verification functionality and similar.

#### 3.4 FINAL INSPECTION

- A. A factory trained representative shall demonstrate that the system functions as specified.
- B. Demonstrate in the presence of the Owner, Local Fire Chief, and the contractor. Invite the Architect's representative.

#### 3.5 INSTRUCTIONS

- A. In addition to the site training on programming features previously specified, provide minimum of two four hour periods to instruct the owner in the proper operation and maintenance requirements of the system. Provide one four hour period at substantial completion (after all testing and the system is fully operational and accepted by the fire department) and the other four hour period six months after substantial completion.
- B. Provide a typewritten, bound, laminated "Sequence of Operation" to the Owner.

END OF SECTION 260721

## SECTION 260741 – TELEPHONE/DATA SYSTEM

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Interior Raceways and Junction Boxes.

#### 1.2 RELATED SECTIONS

- A. Section 061000: Rough Carpentry
- B. Section 099000: Painting: Field Painting of Backboards and Cabinets.
- C. Section 260010: Basic Electrical Requirements.
- D. Section 260111: Conduit.
- E. Section 260130: Boxes.
- F. Section 260195: Electrical Identification.
- G. Section 260470: Panelboards.
- H. Section 260141: Wiring Devices

#### 1.3 QUALITY ASSURANCE

- A. Install work in accordance with University of Southern Maine's standards, rules and regulations.

#### 1.4 SUBMITTALS

- A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Section 013300.

#### 1.5 PROJECT RECORD DOCUMENTS

- A. Accurately record actual locations and mounting heights of outlets if not as shown on Drawings, plus pull and junction boxes larger than 12x12x6 inches, racks, backboard and panels.
- B. Accurately record actual routing of conduits larger than 2 inches and cables containing 25 pairs or more. Indicate dimension from nearest column lines on As-Built Drawings.

#### 1.6 PROJECT CONDITIONS

- A. The Telephone System is existing and will be modified and extended as required by the Owner.
- B. The Data Networking System (racks, patch panels, switches, etc...) is existing and will be modified and extended as required by the Owner.

1.7 COORDINATION

- A. Locate such that outlets are readily accessible.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces are ready to receive work.
- B. Verify that field measurements are as shown on Drawings.

3.2 INSTALLATION

- A. Install properly supported conduit(s) as detailed from each outlet location to above an accessible ceiling.
- B. Install polyethylene pulling string in each empty conduit.

END OF SECTION 260741

## SECTION 312000 - EARTH MOVING

### 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 the following:
  - 1. Preparing subgrades and finish grades. Cutting, filling, and providing additional materials required.
  - 2. Excavating, filling, and backfilling to grade.
  - 3. Excavating and backfilling for buried structures, pipes, wires, and conduits inside or outside of buildings.
  - 4. Subbase and base course gravel for walks.
- B. Related Sections include the following:
  - 1. Division 01 Section "Unit Prices" for unit-price rock excavation and authorized additional excavation provisions.
  - 2. Division 01 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
  - 3. Division 03 Section "Cast-In-Place Concrete".
  - 4. Divisions 21, 22, 23, 26, and 27 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.
  - 5. Division 32 Section "Turf and Grasses" for finish grading, including preparing and placing topsoil and planting soil for lawns.

#### 1.3 UNIT PRICES

- A. Unit prices for earthwork are included in Division 01 Section "Unit Prices."
- B. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following. Unit prices for rock excavation include replacement with approved materials.
  - 1. Excavation which measures 6'-0" or less in width, regardless of length, shall be classified as trench excavation.
  - 2. Excavation which does not meet the requirements for trench excavation shall be classified as open (bulk) excavation.
  - 3. The owner will take credit for excavation and/or fill omitted through changes from the Plans and/or Specifications at the unit price stated.
  - 4. 24 inches outside of concrete forms other than at footings.
  - 5. 12 inches outside of concrete forms at footings.
  - 6. 6 inches outside of minimum required dimensions of concrete cast against grade.
  - 7. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
  - 8. 12 inches beneath bottom of concrete slabs-on-grade.

9. 4 inches beneath pipe in trenches, and the greater of 30 inches wider than pipe or 36 inches wide.

#### 1.4 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
  1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.
- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Fill: Crushed stone backfill to facilitate stormwater flow; that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
  2. Open (bulk) Excavation: Excavation more than 6 feet in width.
  3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Foundation Backfill: Clean course free-draining granular borrow adjacent to building foundation walls.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 2 cu. yd. for bulk excavation, footing, trench, and pit excavation that cannot be removed by rock excavating equipment, without systematic drilling, ram hammering, or blasting. Fragmented "weathered" rock which can be removed by excavation equipment with "ripper" teeth will be considered earth.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.



- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Each type of plastic warning tape.
  - 2. Geotextile.
  - 3. Insulation board.
- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site and borrow soil material proposed for fill and backfill.
- C. Seismic Survey Report: For record purposes; from seismic survey agency.

## 1.6 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

## 1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect, and then only after arranging to provide temporary utility services according to requirements indicated.
  - 1. Notify Architect, Owner, and utility company not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than **6 inches** in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a **6-inch (150-mm)** sieve, 25-70 percent passing a 1/4-inch (**6-mm**) sieve, 0-30 percent passing a No. 40 (**0.425-mm**) sieve, and not more than 7 percent passing a **No. 200 (0.075-mm)** sieve. Maximum size stone passes 6-inch sieve. MDOT spec. 703.06 Type D.
- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a **2-inch (50-mm)** sieve, 45-70 percent passing a 1/2-inch (**13-mm**) sieve, 30-55 percent passing a 1/4-inch (**6-mm**) sieve, 0-20 percent passing a No. 40 (**0.425-mm**) sieve, and not more than 5 percent passing a **No. 200 (0.075-mm)** sieve. MDOT spec. 703.06 Type A.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with 100 percent passing a **2-inch (50-mm)** sieve, 25-100 percent passing 1/4-inch (**6-mm**) sieve, 0-30 percent passing the No. 40 (**0.425-mm**) sieve, and not more than 7 percent passing a **No. 200 (0.075-mm)** sieve.
- G. Drainage Fill (Crushed Stone): Narrowly graded mixture of washed crushed stone; ASTM C 33; grading Size 56; with 100 percent passing a **1-1/2-inch (37.5-mm)** sieve and 0 to 5 percent passing a **No. 4 (4.75-mm)** sieve.
- H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## 2.2 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
  - 1. Survivability: Class 2; AASHTO M 288.
  - 2. Grab Tensile Strength: **120 lbf**; ASTM D 4632.
  - 3. Tear Strength: **50 lbf**; ASTM D 4533.
  - 4. Puncture Strength: **65 lbf**; ASTM D 4833.
  - 5. Apparent Opening Size: **No. 70 (0.212-mm)** sieve, maximum; ASTM D 4751.
  - 6. Permittivity: 2.0 per second, minimum; ASTM D 4491.
  - 7. UV Stability: 70 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf (1100 N); ASTM D 4632.
3. Sewn Seam Strength: 222 lbf (990 N); ASTM D 4632.
4. Tear Strength: 90 lbf (400 N); ASTM D 4533.
5. Puncture Strength: 90 lbf (400 N); ASTM D 4833.
6. Apparent Opening Size: No. 60 (0.250-mm) sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

### 2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
  1. Portland Cement: ASTM C 150, Type I.
  2. Fly Ash: ASTM C 618, Class C or F.
  3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch (10-mm) nominal maximum aggregate size.
  4. Water: ASTM C 94/C 94M.
  5. Air-Entraining Admixture: ASTM C 260.
- B. Produce conventional-weight, controlled low-strength material with 140-psi (965-kPa) compressive strength when tested according to ASTM C 495.

### 2.4 INSULATION BOARD

- A. Extruded polystyrene with a "K" factor of 0.18, with 2.2 lb./cu. ft. density, and 30 psi compressive strength, manufactured by Dow Chemical, or approved equal. ASTM C 578, Type VI.

### 2.5 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility; colored as follows:
- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches (150 mm) wide and 4 mils (0.1 mm) thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches (750 mm) deep; colored as follows:
  1. Red: Electric.
  2. Yellow: Gas, oil, steam, and dangerous materials.
  3. Orange: Telephone and other communications.
  4. Blue: Water systems.
  5. Green: Sewer systems.
  6. White: Steam systems.
  7. Gray: Compressed Air.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Dewater to 12" below subgrade level. Maintain until dewatering is no longer required.
  - 3. Water from construction dewatering operations shall be cleaned of sediment before reaching wetlands, water bodies, streams, or site boundaries. Conform to the requirements of the Department of Environmental Protection, and Erosion Control Notes drawing C00.3.

### 3.3 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Prior to blasting and rock excavation, provide survey grades of the top of the ledge surface, and calculations of the expected rock quantities to be excavated. Submit this data and obtain Architect's approval prior to proceeding with rock excavation. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents.
  - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
    - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
  - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the dimensions listed in paragraph 1.3 Unit Prices.

### 3.4 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus **1 inch (25 mm)**. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Excavate using smooth bucket equipment to not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Excavation for Underground Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus **1 inch (25 mm)**. Do not disturb bottom of excavations intended as bearing surfaces.

### 3.5 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.6 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
  - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line, unless pipe inverts are shown otherwise.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to **12 inches (300 mm)** higher than top of pipe or conduit, unless otherwise indicated.
  - 1. Clearance: As indicated on drawings.
- C. Trench Bottoms: For ductile iron pipe trenches, excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
  - 1. For pipes and conduit less than **6 inches (150 mm)** in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
  - 2. For pipes and conduit **6 inches (150 mm)** or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
  - 3. Excavate trenches **6 inches (150 mm)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.
- D. Trench Bottoms: For pipe materials other than ductile iron, excavate trenches **4 inches (100 mm)** deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
  - 1. Excavate trenches **6 inches (150 mm)** deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

### 3.7 SUBGRADE INSPECTION

- A. Notify Architect and Geotechnical Engineer when excavations have reached required subgrade.

- B. If Geotechnical Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted structural fill, as directed.
- C. Proof-roll subgrade below the building slabs and pavements, as directed by the Geotechnical Engineer. Do not proof-roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Geotechnical Engineer, without additional compensation.

### 3.8 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of **2500 psi (17.2 MPa)**, may be used when approved by Geotechnical Engineer.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Geotechnical Engineer.

### 3.9 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.10 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.
  - 3. Testing and inspecting underground utilities.
  - 4. Removing concrete formwork.
  - 5. Removing trash and debris.
  - 6. Removing temporary shoring and bracing, and sheeting.
  - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.11 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Place and compact initial backfill of bedding course material, free of particles larger than **1 inch (25 mm)** in any dimension, to a height of **12 inches (300 mm)** over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- D. Backfill voids with bedding course material while installing and removing shoring and bracing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, **12 inches (300 mm)** below finished grade, except **6 inches (150 mm)** below subgrade under pavements and slabs.

### 3.12 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
  1. Under grass and planted areas, use satisfactory soil material.
  2. Under walks and pavements, use gravel subbase and base.
  3. Under steps and ramps, use gravel subbase and base.
  4. Under building slabs, use gravel base course.
  5. Under footings and foundations, use gravel base course.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.13 INSULATION BOARD

- A. Place a leveling course of sand, **2 inches (50 mm)** thick, over subgrade. Finish leveling course to a tolerance of **1/2 inch (13 mm)** when tested with a **10-foot (3-m)** straightedge.
  1. Place leveling course on subgrades free of mud, frost, snow, or ice.
- B. Install insulation board in layers with abutting edges and ends along pipelines or other objects to be insulated.

### 3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
  1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than **12 inches** in loose depth for material compacted by heavy compaction equipment, and not more than **6 inches** in loose depth for material compacted by hand-operated tampers.

- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under structures, building slabs, steps, walks, and pavements, scarify and recompact top **12 inches (300 mm)** of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under lawn or unpaved areas, scarify and recompact top **6 inches (150 mm)** below subgrade and compact each layer of backfill or fill soil material at 90 percent.
  - 3. For utility trenches, compact each layer of initial and final backfill soil material at 95 percent.

### 3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Lawn or Unpaved Areas: Plus or minus **1 inch (25 mm)**.
  - 2. Pavements and walks: Plus or minus **1/2 inch (13 mm)**.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of **1/2 inch (13 mm)** when tested with a **10-foot (3-m)** straightedge.

### 3.17 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 33 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a **6-inch (150-mm)** course of drainage fill material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of **18 inches** of drainage fill material, placed in compacted layers **6 inches** thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least **6 inches**.
  - 1. Compact each layer with two passes of a plate-type vibratory compactor.

### 3.18 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade or granular fill layer, place subbase and base course under pavements and walks as follows:
  - 1. Where fill is required, place satisfactory soil on prepared subgrade.
  - 2. Place base course material over subbase course under hot-mix asphalt pavement, concrete pavement, and unit pavers.
  - 3. Shape subbase and base course to required crown elevations and cross-slope grades.



4. Place subbase and base course **6 inches (150 mm)** or less in compacted thickness in a single layer.
5. Place subbase course that exceeds **6 inches (150 mm)** in compacted thickness in layers of equal thickness, with no compacted layer more than **6 inches (150 mm)** thick or less than **3 inches (75 mm)** thick.
6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

### 3.19 FILL BENEATH BUILDING

- A. Prior to placing concrete or soil, obtain approval of the exposed subgrade soil from the Geotechnical Engineer.
- B. Salvage clean excavated granular soil from beneath building slab cut areas, and keep it separated from the excavated subsoil. Do not re-use excavated native soil beneath the building if it is disapproved by the Geotechnical Engineer.
- C. Place and compact the granular fill under cast-in-place concrete slabs-on-grade as follows:
  1. Place a 12" compacted layer of salvaged clean granular soil or gravel base over the prepared subgrade, with no compacted layer more than **8 inches** thick or less than **3 inches** thick. Place granular soil after filling interior utility trenches.
  2. Compact each layer to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
  3. Fill shall be placed under direct supervision of a Geotechnical Engineer. Fill placed without the presence of the Geotechnical Engineer shall be removed and refilled under his supervision.

### 3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
  1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every **1000 sq. ft.** or less of paved area or building slab, but in no case fewer than 2 tests.
  2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each **100 feet (30 m)** or less of wall length.

3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 100 feet (30 m) or less of trench length.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

### 3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property. Comply with the requirements of Division 01.

END OF SECTION 312000

## SECTION 321216 - ASPHALT PAVING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. Section Includes:
  - 1. Saw-cutting of existing hot-mix asphalt pavement.
  - 2. Hot-mix asphalt patching.
  - 3. Hot-mix asphalt paving.
- B. Related Sections:
  - 1. Division 31 Section "Earth Moving" for aggregate subbase and base courses.

#### 1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
  - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
  - 2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.
- C. Qualification Data: For qualified Installer.
- D. Material Certificates: For each paving material, from manufacturer.
- E. Material Test Reports: For each paving material.
  - 1. Field density test results of one test for each 100 tons of bituminous paving.

#### 1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by Maine Department of Transportation.
- B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.
- C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

- D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the latest revision of “Standard Specifications for Highways and Bridges” of the State of Maine Department of Transportation (MDOT), for asphalt paving work.
  - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

## 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet, frozen or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
  - 1. Tack Coat: Minimum surface temperature of 60 deg F (15.6 deg C).
  - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F (4.4 deg C) and rising at time of placement.
  - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F (15.6 deg C) at time of placement.

## PART 2 - PRODUCTS

### 2.1 AGGREGATES

- A. General: Course and fine aggregate for hot-mix asphalt shall be of such gradation that when combined in the proper proportions, including filler if required, will meet the composition mixture for the type of pavement specified.
- B. Coarse Aggregate: Material retained on the No. 8 (2.36 mm) sieve, shall be crushed stone or crushed gravel and, unless otherwise stipulated, shall consist of clean, tough, durable fragments free from an excess of soft or disintegrated pieces and free from stone coated with dirt or other objectionable matter.
- C. Fine Aggregate: Material that passes the No. 8 (2.36 mm) sieve shall consist of natural sand, manufactured sand, or a combination of these. It shall consist of hard, tough grains, free from injurious amounts of clay, loam, or other deleterious substances. Fine aggregate, shall not exceed an absorption of 3% by weight as determined by AASHTO T84.
  - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

### 2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 conform to MDOT specification Sec. 702.
- B. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application. Emulsified asphalt conforming to MDOT 702.04.
- C. Water: Potable.

## 2.3 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and complying with the following requirements:
1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
  2. Walks:
    - a. Surface Course: Conforming to HMA 9.5mm. MDOT, Section 703.09.
    - b. Binder Course: Conforming to HMA 19mm. MDOT, Section 703.09.

Sieve Size	Percent by Weight Passing – Combined Aggregate		
	Type 19 mm (B)	Type 12.5 mm (C)	Type 9.5 mm (D)
25 mm (1")	100		
19 mm (3/4")	90-100	100	
12.5 mm (1/2")	-90	90-100	100
9.5 mm (3/8")	-	-90	90-100
4.75 mm (No. 4)	-	-	-90
2.36 mm (No. 8)	23-49	28-58	32-67
75 µm (No. 200)	2-8	2-10	2-10

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.
- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction. Limit vehicle speed to **3 mph (5 km/h)**.
  2. Proof roll, where possible, with a loaded 10-wheel, tandem-axle dump truck weighing not less than **15 tons (13.6 tonnes)**.
  3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

### 3.2 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending **12 inches (300 mm)** into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of **0.05 to 0.15 gal./sq. yd. (0.2 to 0.7 L/sq. m)**.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

### 3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of **0.05 to 0.15 gal./sq. yd.** (**0.2 to 0.7 L/sq. m**).

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
3. Treat exposed existing horizontal and vertical pavement surfaces with sprayed bituminous tack coat prior to placing new adjacent or overlaying bituminous pavement. Pavement which has been in place longer than 30 days shall be considered existing.

### 3.4 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place hot-mix asphalt base course in thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of **250 deg F (121 deg C)**.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

- B. Place paving in consecutive strips not less than **10 feet (3 m)** wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

### 3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of **6 inches (150 mm)**.

3. Offset transverse joints, in successive courses, a minimum of **24 inches (600 mm)**.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AIMS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

### 3.6 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
  1. Complete compaction before mix temperature cools to **185 deg F (85 deg C)**.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the density established in the MDOT specification.
  1. Average Density: 95 percent of laboratory density according to MDOT, but not less than 92.5 percent nor greater than 97.5 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.7 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
  1. Base Course: Plus or minus **1/2 inch (13 mm)**.
  2. Surface Course: Plus **1/4 inch (6 mm)**, no minus.

- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
  - 1. Base Course: 3/8 inch.
  - 2. Surface Course: 1/4 inch.
  - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

### 3.8 FIELD QUALITY CONTROL

- A. Testing Agency: The Owner may engage a qualified testing agency to perform tests and inspections. This will not relieve the Contractor of his quality control responsibilities.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to MDOT Specifications.
  - 1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
  - 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

### 3.9 DISPOSAL

- A. Remove excavated materials from Project site and recycle them in an approved facility.
  - 1. Do not allow milled materials to accumulate on-site.

END OF SECTION 321216



## SECTION 329200 - TURF AND GRASSES

### 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. Loaming.
  - 2. Seeding.
  - 3. Erosion-control material(s).
- B. Related Sections:
  - 1. Division 31 Section "Earth Moving" for excavation, filling and backfilling, and rough grading.

#### 1.3 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product.
- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.
- C. Qualification Data: For qualified landscape Installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. Material Test Reports: For all soil types for including initial and final tests.
- F. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required initial maintenance periods.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf establishment.
  - 1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
  - 2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
  - 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
  - 4. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; soluble salts; deleterious material; pH; and mineral and plant-nutrient content of the soil.
  - 1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
  - 2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Architect. A minimum of ten representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
  - 3. Report suitability of tested soil for turf growth.

- a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. (92.9 sq. m) or volume per cu. yd. (0.76 cu. m) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
- b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- c. Forward to the Architect two copies of analysis and recommendations of the testing agencies.

D. Preinstallation Conference: Conduct conference at Project site.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
  - 1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
  - 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
  - 3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.
- C. Replacements: In the event of damage or rejection, immediately make repairs and replacements necessary to the approval of the Architect, at no additional cost to the Owner.

## 1.7 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
  - 1. Spring Planting: April 15th to June 15th.
  - 2. Fall Planting: August 15th to September 15th.
- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.
- C. Variance: If special conditions exist which may warrant a variance in the above planting dates, a written request shall be submitted to the Architect stating the special conditions for the proposed variance. Permission for the variance will be given if warranted in the opinion of the Architect. Regardless of the time of seeding, the Contractor shall be responsible for a full growth of grass.

- D. Place permanent soil stabilization within 15 days of final grading.

## 1.8 MAINTENANCE PERIOD

- A. Initial Turf Maintenance Period: Provide full maintenance by skilled employees. Maintain as required in Part 3. Begin maintenance immediately after area is planted and continue until acceptable turf is established but for not less than the following periods:
  - 1. Seeded Turf: 60 days from date of Project Substantial Completion.
    - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

## PART 2 - PRODUCTS

### 2.1 SEED

- A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.
- B. Seed Species: State-certified seed of grass species as follows, with not less than 80 percent germination, not less than 85 percent pure seed, and not more than 0.25 percent weed seed:
  - 1. General Lawn Areas: Proportioned "shade-tolerant" mix by weight as follows:
    - a. 40 percent creeping red fescue.
    - b. 20 percent chewings fescue.
    - c. 20 percent hard fescue.
    - d. 20 percent Kentucky Bluegrass

### 2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
  - 1. Class: T, with a minimum of 99 percent passing through **No. 8 (2.36-mm)** sieve and a minimum of 75 percent passing through **No. 60 (0.25-mm)** sieve.
  - 2. Provide lime in form of ground dolomitic limestone .
- B. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, and with a minimum of 99 percent passing through **No. 6 (3.35-mm)** sieve and a maximum of 10 percent passing through **No. 40 (0.425-mm)** sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Aluminum Sulfate: Commercial grade, unadulterated.
- E. Perlite: Horticultural perlite, soil amendment grade.
- F. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through **No. 50 (0.30-mm)** sieve.
- G. Sand: Clean, washed, natural or manufactured, and free of toxic materials.

## 2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Shall meet Maine Department of Environmental Protection guidelines under Chapter 567: Section C and must be approved for commercial landscaping. Vendor shall provide approximate nitrogen availability calculations for soil blending and complete set of available plant nutrients, pH, trace metals, total volatile solids, soluble salts, measured water holding capacity and maturity measurements. Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through **3/8-inch** sieve; soluble salt content of 0 to 4 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
1. Organic Matter Content: 50 to 60 percent of dry weight.
  2. C:N Ratio: 20:1 – 35:1
  3. Total Nitrogen: <1.5%
  4. Moisture Content: 40 – 60%
  5. Total Volatile Solids: <60%
  6. Density: 800-1200 lbs/cy
  7. Feedstock: Equal portions of municipal bio-solids, short paper fiber, wood ash and sawdust and be the product of 15 days of thermophilic aerobic decomposition followed by 90 days of curing.
  8. Compost will be adequately stabilized, pathogen free with acceptable odor.
  9. Compost source is subject to the review of the Engineer.
- B. Peat: Peat shall be moist. It shall be finely shredded, consist of 90 percent organic moss peat, be brown in color, and suitable for horticultural purposes. Shredded particles shall not exceed one (1) inch in diameter. Peat shall be measured in air dry condition, containing not more than 35 percent moisture by weight. Ash content shall not exceed 10 percent.

## 2.4 FERTILIZERS

- A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.
  2. Approximately 30% to 50% of the fertilizer shall be a slow release form (UF IDBU SCU).
  3. Delivered to the site in bags labeled with manufacturers guaranteed analysis.
  4. Special Protection: If stored at the site, protect fertilizer from the elements.

## 2.5 PLANTING SOILS

- A. Topsoil: Topsoil for general site loam, except that existing on the site, will not be made available by the Owner. The Contractor shall be responsible for supplying any additional topsoil needed and hauling it to the site. It shall be obtained from naturally well drained areas. Whether from on-site or off-site source, the topsoil shall be a fertile, friable natural loam. ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 7percent organic material content nor more than 18%; soluble salts less than 500 parts per million; free of stones **3/4 inch** or larger in any dimension and other extraneous materials harmful to plant growth. Soil shall not be used for planting while in frozen or muddy condition. Unsuitable materials removed shall be disposed of by the Contractor. Topsoil for general loam areas, unless noted otherwise, shall meet the following requirements:

1. Maximum particle size of 3/4-inch, with maximum of 3% retained on the 1/4-inch mesh sieve. Composition in the following range:
    - a. Silt: 15 to 40%
    - b. Sand: 30 to 70%
    - c. Clay: 3 to 15%
  2. Initial Testing: Take representative samples of topsoil from the site and from borrow sources and submit samples to a Soil Testing Laboratory for chemical and physical analysis. Each sample shall be made by combining 10 small grab samples from throughout the source. Indicate to the testing agencies that turf is to be planted and the name of the Owner. Forward to the Architect two copies of analysis and recommendations of the testing agencies.
  3. Final Testing: After the final topsoil has been amended and mixed as recommended, take representative samples and submit them to a Soil Testing Laboratory for chemical and physical analysis. Each sample shall be made by combining 10 small grab samples from throughout the source. Make final amendments to the topsoil to meet the specification, based on the test results. Forward to the Architect two copies of analysis and recommendations of the testing agencies.
- 2.6 Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. MULCHES
- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.
- 2.7 PESTICIDES
- A. General: Use of pesticides/herbicides must be coordinated with Owner's Integrated Pest Management Plan, and used only by Owner's permission. Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.
  - B. Pre-Emergent Herbicide (Selective and Non-Selective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
  - C. Post-Emergent Herbicide (Selective and Non-Selective): Effective for controlling weed growth that has already germinated.
- 2.8 EROSION-CONTROL MATERIALS
- A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.
    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. North American Green; P300.

- B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of **0.92 lb/sq. yd (0.5 kg/sq. m)**, with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, **6 inches (150 mm)** long.
- C. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped surface, of **3-inch (75 mm)** nominal mat thickness. Include manufacturer's recommended anchorage system for slope conditions.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
  1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
  2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
  3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
  4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

### 3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
  1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
  2. Protect grade stakes set by others until directed to remove them.
- B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

### 3.3 TURF AREA PREPARATION

- A. Limit turf subgrade preparation to areas to be planted.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of **3 inches (75 mm)** to **6 inches (150 mm)**. Remove stones larger than **1-1/2 inches (38 mm)** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
  1. Spread planting soil to a depth of **4 inches** but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

- C. Apply fertilizer at a rate as recommended by testing agency, just prior to final grading of the site. Thoroughly and evenly incorporate fertilizer and lime with the soil to a depth of 4" to 6" by discing or other approved method. In areas inaccessible to power equipment, use hand tools. Adjacent to trees and shrubs use hand tools to avoid disturbance of the roots.
- D. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch (13 mm) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future. Remove stones larger than 1 inch in diameter. It shall be free of smaller stones in excessive quantities, as determined by the Architect.
- E. The whole surface shall then be rolled with a roller which weighs not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil, and the surface shall be regraded and rolled until presenting a smooth and even finish to the required grade.
- F. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- G. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

#### 3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.
- C. Fill cells of erosion-control mat with planting soil and compact before planting.
- D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

#### 3.5 SEEDING

- A. Sow seed with Brillion seeder or other approved or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
  - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
  - 2. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.
- B. Sow seed at a total rate of 5 lb/1000 sq. ft. (2.3 kg/92.9 sq. m).



- C. Sow 50% in one direction and 50% at right angles to the first seeding. Spread seed when soil is moist. Cultipacker, or approved similar equipment, may be used to cover the seed and to firm the seed bed in one operation.
- D. In areas inaccessible to cultipacker, the seeded ground shall be lightly raked into top 1/8 inch of soil and rolled lightly in two directions with a water ballast roller. Extreme care shall be taken during seeding and raking to insure that no change shall occur in the finished grades and that the seed is not raked from one spot to another.
- E. Promptly after seeding, wet the seed bed thoroughly, keeping all areas moist throughout the germination period.
- F. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.
- G. Protect seeded areas with erosion-control mats where shown on Drawings; install and anchor according to manufacturer's written instructions.
- H. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of **2 tons/acre (42 kg/92.9 sq. m)** to form a continuous blanket **1-1/2 inches (38 mm)** in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.
- I. Take whatever measures are necessary to protect the seeded area while it is germinating. These measures shall include furnishing warnings signs, barriers, and other needed measures of protection.

### 3.6 TURF MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
  - 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
  - 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
  - 3. Use integrated pest management practices as required to keep turf and soil free of pests and pathogens or disease.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of **4 inches (100 mm)**.
  - 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
  - 2. Water turf with fine spray at a minimum rate of **1 inch (25 mm)** per week unless rainfall precipitation is adequate.

- C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
  - 1. At the time of the first cutting, there shall be a uniform stand between 3 and 3 ½ inches high, and mower blades shall be set between 2 ½ inches and 3 inches high.
  - 2. Provide at least 3 cuttings of grass in lawn areas not closer than 10 days apart.

### 3.7 SATISFACTORY TURF

- A. Turf installations shall meet the following criteria as determined by Architect:
  - 1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. (0.92 sq. m) and bare spots not exceeding 5 by 5 inches (125 by 125 mm).
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.
- C. Correct graded areas which settle during the first 12 months after Project Substantial Completion in lawn areas, including loaming and seeding. Reseeding shall be done as herein specified.

### 3.8 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. When this work is done while buildings are occupied, pavements shall be kept broom cleaned to prevent tracking dirt into buildings.
- C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.
- D. Remove nondegradable erosion-control measures after grass establishment period.
- E. After completion of planting operations, dispose of debris and excess material to the satisfaction of the Architect. Pavements shall be broomed and hosed clean.

### 3.9 FINAL INSPECTION AND ACCEPTANCE

- A. At the end of the guarantee period, the Architect will inspect guaranteed work for the Final Acceptance upon written request of the Contractor. The request shall be received at least 10 calendar days before the anticipated date for final inspection.
- B. Upon completion and re-inspection of repairs or renewals necessary in the judgment of the Architect at that time, he shall certify in writing to the Contractor as to the Final Acceptance of the project.

END OF SECTION 329200