HARRIMAN

Architects + Engineers

University of Maine System
Data Center Upgrades
Portland, Maine

Project No. 09533

May 9, 2011

Issued for Bid

Auburn Business Park, 46 Harriman Drive, Auburn, Maine 04210 207-784-5100 www.harriman.com

8 2011 Harriman

PROJECT MANUAL

FOR

UMS Data Center Upgrades
Project #2009-009

at

The Science Building, 70 Falmouth St., Portland, ME 04104

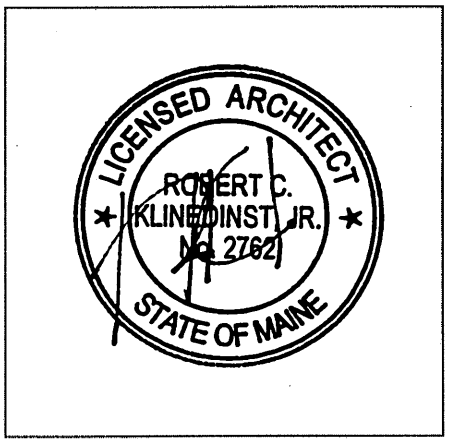
UNIVERSITY OF SOUTHERN MAINE
Portland, MAINE

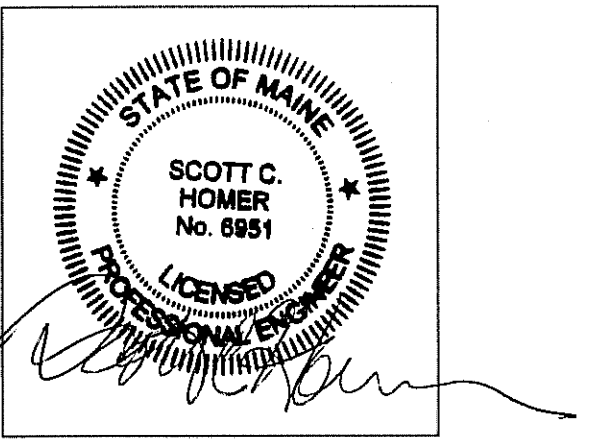
Prepared by:

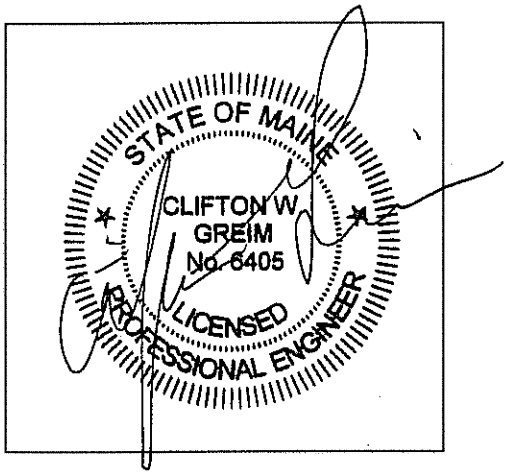
University of Southern Maine Facilities Management
May 9, 2011

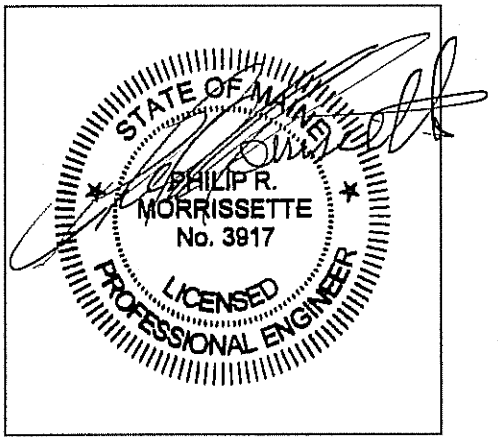
UMS Data Center Upgrades - 2009-009
The University of Southern Maine

Professional Seal Page









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Project #2009-009
University of Southern Maine
Portland, Maine

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Not Used

SECTION 00 01 15
LIST OF DRAWINGS

List of Drawings for UMS Data Center Upgrades – 2009-009 dated May 9, 2011.

LIST OF DRAWINGS

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P05.1	DEMOLITION 2ND FLOOR PLAN & GROUND FLOOR PLAN
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END OF SECTION 00 01 15

Advertisement for Bids

The University of Southern Maine, a member of the University of Maine System, desires to procure construction services to renovate the existing UMS Data Center including space upgrades, cooling equipment replacement and electrical upgrades in the Science Building on the USM Portland Campus.

A **Mandatory pre-bid meeting** and facility walk-through will be held on **May 26, 2011** at 10:00 AM in USM Science Building Lobby, 70 Falmouth Street, Portland, ME 04104.

Bidding Documents will be available on May 12, 2011, at cost of $100 from:

Harriman Architects and Engineers
46 Harriman Drive
Auburn, ME 04210
207-784-5100

Notice to Proceed is anticipated shortly after the bid opening, and Substantial Completion is October 31, 2011.

Printed Plans and Specifications may be viewed at the Facilities Management Department (25 Bedford Street, Portland). All General Bidders must obtain a full set of Plans and Specifications 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:
2009-009 – UMS Data Center Upgrades
University of Southern Maine, Portland Campus

Addressed to:
University of Southern Maine
c/o **Mr. Adam Thibodeau, LEED AP, Project Engineer**
Facilities Management, 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 June 3, 2011** 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,
Gorham Campus
Robert W. Bertram,
Executive Director of Facilities Management for
The University of Maine System Board of Trustees

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

1. At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument, or document shall not relieve any bidder from any obligation in respect to the bid. The Owner reserves the right to accept or reject any or all bids as may best serve the interests of the University of Maine System.

2. Subject to the University System's right, reserved herein, to accept or reject any or all bids, the General Contractor will be selected on the basis of the sum of the lowest base bid, plus such of the alternates as the University System desires to use.

3. The University System is exempt from the payment of Federal Excise Taxes on articles not for resale and the Federal Transportation Tax on all shipments. The Contractor shall quote less these taxes. Upon application, exemption certificates will be furnished when required.

4. No proposal may be withdrawn during a period of thirty (30) calendar days immediately following the opening thereof.

5. No contract may be assigned, sublet or transferred without the written consent of the University of Maine System.

6. All individuals not residents of this State must comply with the provisions of 14 MRSA §704-A.

7. The successful bidder, or bidders, will be required to furnish 100% Contract Bonds to cover the execution of the contract, in accordance with Article 11 of the AIA Document A201 – 2007 General Conditions of the Contract for Construction as amended by University of Maine System 00 73 00 Supplementary Conditions of the AIA A201 – 2007 General Conditions of the Contract for Construction.

8. Contractors may be required to furnish a statement of their business experience, record of accomplishments, and financial responsibility, at the discretion of the University System.

9. The base bid shall be based on the materials, methods, equipment and products, as specified.

10. Any materials, methods, equipment and products not herein specified, but worthy of consideration by any General or Subcontractor, may be introduced by a separate letter attached to the regular bid. The Bidder shall state the cost comparison with the specified materials, methods, equipment and products, and the reason for the suggested substitution. It shall be understood by all bidders that the attached letter proposing substitutions shall not be used to determine the low bidder and that all bids are based on specified products.

11. Telegraphic or facsimile proposals will not be considered, but modification of proposals already submitted will be considered if received prior to the hour set for receipt of proposals. If the telegram or facsimile discloses the amount of the proposal, the proposal will be declared invalid. The bidder bears full responsibility to assure that the correction is delivered to the proper location and within the time required.

12. Where a bidder wishes a product to be considered an "approved equal" for bidding purposes, the product, along with all supporting documentation, shall be submitted to the architect for review a minimum of 10 calendar days prior to the bid opening date or the file bid due date, if file bids are required on the project. Products which are determined to be an "approved equal" for bidding purposes shall be listed in an addendum issued so as to be received by bidders no less than 72 hours prior to the bid date or the file bid due date if file bids are required.

13. Where the Proposal Form requires the tabulation of subcontractors other than "File Bidders," the Bidder shall list the name of the firm the bidder intends to use in the event the bidder receives the contract award.

*** END OF SECTION 00 21 13 ***

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Bid Form

BIDDER:

_____

_____

_____

University of Maine **, UNIVERSITY OF SOUTHERN MAINE**
c/o **Robert W. Bertram**
Executive Director of Facilities Management
P. O. Box 9300, 25 Bedford Street, Portland, ME 04104-9300

Having carefully examined the form of contract, general conditions and plans and specifications contained therein for **UMS DATA CENTER UPGRADES**, 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 N/A Alternate #3 N/A

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 November 30, 2011. 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.

*** Date ***

*** Contractor ***
*** Address ***
*** City, State Zip ***

RE: Notice of Award *** Project Name and Campus ***

Dear *** Contractor Name ***:

You are hereby notified that the *** Campus *** acting on behalf of the University of Maine System accepts your Bid of **$* Total Amount including as statement as to any alternates that are included *** for the above named project, subject to final resolution of any bid protests and the parties' ability to establish and confirm final terms, as well as the execution of a written contract and your furnishing satisfactory bonds within twelve (12) calendar days as provided in the bidding documents.

This Notice of Award will permit you to proceed with the ordering of materials and scheduling the work so that the project can be completed on time. Should you fail to execute a contract or furnish satisfactory bonds within the stipulated time; the bid bond accompanying your proposal will be forfeited to the University of Maine System as liquidated damages.

Enclosed are three (3) originals of your contract agreement for signature. Further, please have your surety provide three (3) originals of the Performance Bond and the Payment Bond, as prescribed in Sections 00 61 13.13 and 00 61 13.16 of the bid document, and a properly executed "Power of Attorney." Please advise your surety agent that the bonds should carry the same date as this Notice of Award and the Contract Agreement. All copies of the signed contract, bonds and insurance certificates should be forwarded directly to this office. Once they are completely signed, a bound copy of the contract will be returned for your use.

Prior to your starting any work on the construction site, this office must receive Certificates of Liability Insurance as specified in Section Article 11 of AIA Document A201 – 2007 General Conditions of the Contract for Construction and Section 00 73 00.01 University of Maine System Supplemental Conditions. Please advise your surety that the certificate holder should be as follows: University of Maine System, 16 Central Street, Bangor, Maine 04401.

The day-to-day administrative and technical details of this project will be administered by the Project Manager. The Project Manager for this project is *** Project Manager's Name ***. All correspondence relative to the day-to-day administration of the project should be directed to *** Address *.**

A pre-construction conference on this project will be scheduled as soon as possible. This conference must be attended by your firm's authorized representative, as well as by your project superintendent.

Sincerely yours,

* Chief Financial Officer Name *
Chief Financial Officer

Enclosures

cc: UM System Office

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 * Campus and Address *.

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 _____, prepared _____, 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: _____ Dollars $_____ 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 _____, 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: _____	By: _____
Signature Authority Name	Title
Signature Authorities Title	
University of Maine * Location *	
_____	_____
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
A.	**General Liability**			
1.	Does the General Aggregate apply to this Project only?	☐	☐	☐
2.	Does this policy include coverage for:			
a.	Premises - Operations?	☐	☐	☐
b.	Explosion, Collapse and Underground Hazards?	☐	☐	☐
c.	Personal Injury Coverage?	☐	☐	☐
d.	Products Coverage?	☐	☐	☐
e.	Completed Operations?	☐	☐	☐
f.	Contractual Coverage for the Insured's obligations in A201?	☐	☐	☐
3.	If coverage is written on a claims-made basis, what is the:			
a.	Retroactive Date?			
b.	Extended Reporting Date?			
B.	**Worker's Compensation**			
1.	If the Insured is exempt from Worker's Compensation statutes, does the Insured carry the equivalent Voluntary Compensation coverage?	☐	☐	☐
C.	**Final Payment Information**			
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?	☐	☐	☐
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?	☐	☐	☐
D.	**Termination Provisions**			
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.	☐	☐	☐
E.	**Other Provisions**			

Authorized Representative

Date of Issue

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User Notes: (1165322291)

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.

INSURERS AFFORDING COVERAGE

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	
	GENERAL LIABILITY				EACH OCCURRENCE	$
	☐ COMMERCIAL GENERAL LIABILITY				FIRE DAMAGE (Any one fire)	$
	☐ ☐ CLAIMS MADE ☐ OCCUR				MED EXP (Any one person)	$
					PERSONAL & ADV INJURY	$
					GENERAL AGGREGATE	$
	GEN'L AGGREGATE LIMIT APPLIES PER:				PRODUCTS - COMP/OP AGG	$
	☐ POLICY ☐ PRO-JECT ☐ LOC					
	AUTOMOBILE LIABILITY				COMBINED SINGLE LIMIT (Ea accident)	$
	☐ ANY AUTO					
	☐ ALL OWNED AUTOS				BODILY INJURY (Per person)	$
	☐ SCHEDULED AUTOS					
	☐ HIRED AUTOS				BODILY INJURY (Per accident)	$
	☐ NON-OWNED AUTOS					
					PROPERTY DAMAGE (Per accident)	$
	GARAGE LIABILITY				AUTO ONLY - EA ACCIDENT	$
	☐ ANY AUTO				OTHER THAN AUTO ONLY: EA ACC	$
					AGG	$
	EXCESS LIABILITY				EACH OCCURRENCE	$
	☐ OCCUR ☐ CLAIMS MADE				AGGREGATE	$
						$
	☐ DEDUCTIBLE					$
	☐ RETENTION $					$
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				☐ 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

Sample

© ACORD CORPORATION 1988

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.

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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".

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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".

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(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;

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(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 sidetrack 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

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(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.

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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.

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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.

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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".

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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

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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.

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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 nonrenewal 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

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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":

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(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

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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.

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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.	

SAMPLE

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.

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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.	

SAMPLE

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".

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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

Designated Location(s):

(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.

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B. 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 cannot be attributed only to operations at a single designated "location" shown in the Schedule above:

1. Any payments made under COVERAGE **A** for damages or under COVERAGE **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.

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AIA® Document G703™ – 1992

Continuation Sheet University of Maine System Project

AIA Document G702, APPLICATION AND CERTIFICATION FOR PAYMENT, containing Contractor's signed certification is attached.
In tabulations below, amounts are in US dollars.
Use Column I on Contracts where variable retainage for line items may apply.

APPLICATION NO: 001
APPLICATION DATE:
PERIOD TO:
ARCHITECT'S PROJECT NO:

A	B	C	D	E	F	G		H	I
ITEM NO.	DESCRIPTION OF WORK	SCHEDULED VALUE	WORK COMPLETED: FROM PREVIOUS APPLICATION (D + E)	WORK COMPLETED: THIS PERIOD	MATERIALS PRESENTLY STORED (NOT IN D OR E)	TOTAL COMPLETED AND STORED TO DATE (D+E+F)	% (G ÷ C)	BALANCE TO FINISH (C - G)	RETAINAGE (IF VARIABLE RATE)
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
		0.00	0.00	0.00	0.00	0.00	0.00 %	0.00	0.00
	GRAND TOTAL	$0.00	$0.00	$0.00	$0.00	$0.00	0.00 %	$0.00	$0.00

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User Notes: (929777463)

AIA® Document G702™ – 1992

Application and Certificate for Payment

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

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
5. RETAINAGE:		
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 (Line 4 Less Line 5 Total)		$ 0.00
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT (Line 6 from prior Certificate)		$ 0.00
8. CURRENT PAYMENT DUE		$ 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6)	$ 0.00	

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
TOTALS	$ 0.00	$ 0.00
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.

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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: _____
Project Title

This project is located at: _____
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® Document G707A™ – 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)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

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

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)

, OWNER,

as set forth in said Surety's bond.

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)

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STORED MATERIALS

University of Maine * Location *
* Campus Address *

Project Title: _____
Location: _____
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		
				Total	

Surety _____ By: _____
Attorney-in-Fact

Power of Attorney Must be Attached

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, incompliance 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, it 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

_____ By: _____
Secretary President

AIA® Document G716™ – 2004

Request for Information ("RFI")

TO: **FROM:**

PROJECT: **ISSUE DATE:** **RFI No.** 001
University of Maine System Project

REQUESTED REPLY DATE:
PROJECT NUMBERS: / **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.

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User Notes: (1916365623)

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)*

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User Notes: (1953973045)

AIA® Document G714™ – 2007

Construction Change Directive

PROJECT: *(Name and address)* University of Maine System Project **TO CONTRACTOR:** *(Name and address)*	**DIRECTIVE NUMBER:** **DATE:** **CONTRACT FOR:** **CONTRACT DATED:** **ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐ CONSULTANT: ☐ CONTRACTOR: ☐ FIELD: ☐ OTHER: ☐

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

1. 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:

2. 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.

ARCHITECT *(Firm name)*	**OWNER** *(Firm name)*	**CONTRACTOR** *(Firm name)*
ADDRESS	**ADDRESS**	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*	**BY** *(Signature)*
(Typed name)	*(Typed name)*	*(Typed name)*
DATE	**DATE**	**DATE**

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(810562134)

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):*

TO CONTRACTOR *(Name and address):*

PROPOSAL REQUEST NUMBER:

DATE OF ISSUANCE:

CONTRACT FOR:

CONTRACT DATE:

ARCHITECT'S PROJECT NUMBER:

OWNER: ☐
ARCHITECT: ☐
CONSULTANT: ☐
CONTRACTOR: ☐
FIELD: ☐
OTHER: ☐

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)* _____

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User Notes: (1484010036)

AIA® Document G701™ – 2001

Change Order

PROJECT *(Name and address)*: University of Maine System Project	**CHANGE ORDER NUMBER:**	OWNER: ☐
	DATE:	ARCHITECT: ☐
TO CONTRACTOR *(Name and address)*:	**ARCHITECT'S PROJECT NUMBER:**	CONTRACTOR: ☐
	CONTRACT DATE:	FIELD: ☐
	CONTRACT FOR:	OTHER: ☐

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.

ARCHITECT *(Firm name)*	**CONTRACTOR** *(Firm name)*	**OWNER** *(Firm name)*
ADDRESS	**ADDRESS**	**ADDRESS**
BY *(Signature)*	**BY** *(Signature)*	**BY** *(Signature)*
(Typed name)	*(Typed name)*	*(Typed name)*
DATE	**DATE**	**DATE**

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User Notes: (726955061)

AIA® Document G704™ – 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.)

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User Notes: (1231253575)

AIA® Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)* University of Maine System Project	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐ CONTRACTOR: ☐
	CONTRACT FOR: General Construction	SURETY: ☐
TO OWNER: *(Name and address)*	**CONTRACT DATED:**	OTHER: ☐

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:

1. 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

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

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.
3. Contractor's Affidavit of Release of Liens (AIA Document G706A).

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:

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User Notes: (1194345551)

AIA® Document G706A™ – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)* University of Maine System Project2	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐ ARCHITECT: ☐
	CONTRACT FOR: General Construction	CONTRACTOR: ☐
TO OWNER: *(Name and address)* University of Maine System 16 Central Street Bangor, ME 04401-5106	**CONTRACT DATED:**	SURETY: ☐ OTHER: ☐

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:

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00 65 19.17

WAIVER OF LIEN

Date:
State of Maine
County of

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

SUBJECT _____

Project Name _____

Project Location _____

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® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)* University of Maine System Project	**ARCHITECT'S PROJECT NUMBER:**	OWNER: ☐
	CONTRACT FOR:	ARCHITECT: ☐
		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)

, SURETY,

on bond of
(Insert name and address of Contractor)

, CONTRACTOR,

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)

, OWNER,

as set forth in said Surety's bond.

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)

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AIA® Document A201™ – 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)

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.

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

TABLE OF ARTICLES

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User Notes: (885711814)

Init.
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(Numbers and Topics in Bold are Section Headings)

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Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 11.4.1, 13.2, 13.4.2, 15.4.4.2
Written Interpretations
4.2.11, 4.2.12

Written Notice
2.3, 2.4, 3.3.1, 3.9, 3.12.9, 3.12.10, 5.2.1, 8.2.2, 9.7, 9.10, 10.2.2, 10.3, 11.1.3, 11.4.6, 12.2.2, 12.2.4, 13.3, 14, 15.4.1
Written Orders
1.1.1, 2.3, 3.9, 7, 8.2.2, 11.4.9, 12.1, 12.2, 13.5.2, 14.3.1, 15.1.2

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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.

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§ 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

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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.

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§ 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.

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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.

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§ 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.

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§ 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.

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University of Maine System
Supplementary Conditions
to
AIA A201 2007General 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 Architects 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 § 4.2.1with 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 B201-2007and 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.

§ 9.6.8 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.

§ 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.

§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 $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

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 -------Datacenter Remediation (8150019)

Location of Project --Portland, Cumberland

2011 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	$17.25	$1.12	$18.37	Ironworker - Reinforcing	$20.37	$5.22	$25.59
Asphalt Raker	$14.00	$0.35	$14.35	Ironworker - Structural	$20.37	$19.27	$39.64
Backhoe Loader Operator	$16.00	$1.99	$17.99	Laborers (Incl.Helpers & Tenders)	$13.00	$0.63	$13.63
Boilermaker	$32.02	$7.82	$39.84	Laborer - Skilled	$15.50	$0.97	$16.47
Boom Truck (Truck Crane) Op	$17.00	$2.04	$19.04	Loader Operator - Front-End	$14.25	$1.54	$15.79
Bricklayer	$22.00	$0.00	$22.00	Mechanic, Automatic - Door	$32.75	$11.89	$44.64
Bulldozer Operator	$18.00	$2.99	$20.99	Mechanic, Maintenance	$23.08	$3.31	$26.39
Carpenter	$18.00	$2.50	$20.50	Mechanic, Refrigeration	$22.25	$4.08	$26.33
Carpenter - Acoustical	$16.00	$1.25	$17.25	Millwright	$22.50	$7.34	$29.84
Carpenter - Rough	$16.44	$1.66	$18.10	Oil/Fuel Burner Servicer & Installer	$19.75	$7.48	$27.23
Cement Mason/Finisher	$18.00	$0.00	$18.00	Painter	$14.00	$0.22	$14.22
Communication Equip Installer	$22.00	$3.88	$25.88	Paver - Bituminous	$18.13	$2.35	$20.48
Crane Operator <15 Tons	$20.00	$4.02	$24.02	Pipe/Steam/Sprinkler Fitter	$21.75	$4.62	$26.37
Crane Operator =>15 Tons)	$20.00	$4.02	$24.02	Plumber (Licensed)	$23.05	$4.48	$27.53
Dry-Wall Applicator	$20.22	$1.06	$21.28	Plumber Helper/Trainee (Licensed)	$19.38	$5.16	$24.54
Dry-Wall Taper & Finisher	$20.86	$0.84	$21.70	Pump Installer	$17.00	$2.54	$19.54
Electrician - Licensed	$23.10	$5.36	$28.46	Roller Operator - Pavement	$16.18	$4.96	$21.14
Electrician Helper/Cable Puller (Licensed)	$15.00	$3.10	$18.10	Roofer	$15.75	$2.08	$17.83
Elevator Constructor/Installer	$48.43	$21.44	$69.87	Sheet Metal Worker	$19.00	$3.66	$22.66
Excavator Operator	$17.30	$2.19	$19.49	Sider	$13.00	$2.26	$15.26
Fence Setter	$13.00	$0.19	$13.19	Stone Mason	$25.50	$0.68	$26.18
Floor Layer	$17.00	$0.00	$17.00	Tile Setter	$18.50	$3.60	$22.10
Glazier	$15.00	$1.05	$16.05	Truck Driver - Light	$15.00	$2.35	$17.35
Grader/Scraper Operator	$17.50	$2.56	$20.06	Truck Driver - Medium	$14.26	$0.84	$15.10
HVAC	$24.50	$5.57	$30.07	Truck Driver - Heavy	$14.25	$1.06	$15.31
Industrial Truck (Forklift) Operator	$20.63	$5.89	$26.52	Truck Driver - Tractor Trailer	$14.77	$3.04	$17.81
Insulation Installer	$16.72	$2.50	$19.22	Truck Driver - Mixer (Cement)	$13.68	$5.57	$19.25

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: B2-054-2011

Filing Date: March 30, 2011

Expiration Date: 12-31-2011

A true copy

Attest: _____

Michael Roland
Acting Bureau Director
Bureau of Labor Standards

BLS 424BU (R2011) (Building 2 Cumberland)

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. Use of premises.
   3. Owner's occupancy requirements.
   4. Work restrictions.
   5. 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: UMS Data Center Upgrades – 2009-009.
   1. Project Location: University of Southern Maine, Science Building, 70 Falmouth St., Portland, ME 04104.

B. Owner: University of Maine System.

C. Architect: Harriman, Auburn Business Park, 46 Harriman Drive, Auburn, ME.

1.4 PROTECTION MAINTENANCE

A. Cooling of Computer Room 237 shall be maintained until new air conditioner is operational.

B. Fire Protection Computer Room 237:
   1. INERGEN System: Notify Owner when system shutdown will occur for the work, and duration of the shutdown. When ceiling is removed and/or the dust partitions are installed, the INERGEN system will not function and shall be shut down. Minimize the duration of the shutdown.
      a. Post a warning sign at the entrance door to the Computer Room 237 stating “INERGEN CLEAN AGENT FIRE SUPPRESSION SYSTEM IS INACTIVE FOR CONSTRUCTION” that will notify the fire department they can enter the room without a waiting period.
   2. Fire Detection System: Temporarily support smoke detectors when ceiling is removed to keep smoke detection system operational. Smoke detectors shall be bagged each day before work starts, and shall be removed at the end of each work day to put the smoke detectors back in service. Notify Owner when detection system shutdown will occur for

connection of new work, and duration of the shutdown. System shall be operational at the end of each workday.

C. Dust Protection: To the maximum extent possible, minimize the amount of dust and dirt exposure to the operating equipment in Computer Room 237. Provide protection of operating equipment in a manner that permits adequate cooling and does not cause equipment to overheat. Temporary cooling shall be in place when the temporary partitions are installed. Vacuum overhead space above existing ceiling and space under the access flooring to reduce the amount of dust stirred up by construction operations. Dust protection shall be in place before the start of hollow metal removal work and installation of new walls. Seal between concrete floor and underside of access flooring to prevent dust migration. Schedule existing overhead ceilings and grid removal at one time to minimize the amount of dust and disruption to the operating facility. To the maximum extent possible, cut new materials that could create dust around the equipment outside of the room.

D. Computer Room 237 Cooling: Work shall be coordinated to provide continuous cooling of the equipment space to prevent overheating of equipment for the duration of the work.

1.5 OWNER-FURNISHED PRODUCTS

A. Owner will furnish products indicated and /or as specified. The Work includes providing support systems to receive Owner's equipment, and install.
   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.

B. Owner-Furnished Products:
   1. Computer room air conditioners and roof top condenser units.

1.6 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 Project site.
   2. Driveways and Entrances: Keep driveways parking, and entrances serving premises clear and available to Owner, Owner's employees, students, 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 secure and weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.7 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. 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.
   2. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.8 WORK RESTRICTIONS

A. On-Site Work Hours: Work shall be generally performed inside the existing building in accordance with the Owner’s schedule issued.

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 Owner not less than three days in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without Owner's written permission.

1.9 SPECIFICATION FORMATS AND CONVENTIONS

A. Specification Format: The Specifications are organized into Divisions and Sections using the CSI's "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 01: Sections in Division 01 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.

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. Alternates are numbered for identification and reference purposes only, and are not number in sequence for selection. The Owner will select alternates based solely on the Owners program and availability of funds, not in any predetermined order.
   3. 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

A. Alternate No. 1 – UPS: Provide Static Uninterruptible System specified in Section 260611.
   1. Associated UPS conduit and wiring from Normal and Emergency power sources to the Computer Room shall be included in the base bid.
   2. The structural support of the access floor system to receive the UPS equipment shall be included in the base bid.

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. The Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

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, Owner 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. 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 Owner 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.
5. Documentation: Submit proper documentation for the amounts being requisitioned from subcontractors and material suppliers with each Application for Payment.
6. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
7. 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.
8. 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.
9. 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.
10. 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.
11. 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.

C. Payment Application Forms: Use University of Maine System form for Applications for Payment. The Owner will furnish the forms in electronic format for the Contractor's use.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Owner 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, if applicable.

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, IDAT 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, and record documents.
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" if project is bonded.
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. Administrative and supervisory personnel.
   2. 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 light 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. 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. Integrated Deliverables and Testing (IDAT).
    l. Preparation of Record Documents.
    m. Use of the premises and existing building.
    n. Work restrictions.
    o. Owner's occupancy requirements.
    p. Responsibility for temporary facilities and controls.
    q. Parking availability.
    r. 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 and Owner 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, including record drawing and documents status, waivers of mechanic's liens, list of completed tests, IDAT 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. 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. Contractor's Construction Schedule.
   2. Daily construction reports.
   3. Field condition reports.
   4. Special reports.

B. Related Sections include the following:
   1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
   2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
   3. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   4. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.
   5. Division 01 Section "Integrated Deliverables and Testing (IDAT)" for submitting checklists, schedules and reports.

1.3 SUBMITTALS

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

B. Daily Construction Reports: Submit two copies at weekly intervals.

C. Field Condition Reports: Submit two copies at time of discovery of differing conditions.

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

1.4 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, 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 CONTRACTOR'S CONSTRUCTION SCHEDULE

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.

C. Construction Schedule: Submit a comprehensive, fully developed, Gantt-chart-type or standardized computer generated construction scheduling program of Contractor's Construction Schedule within 15 days of date established for the Notice to Proceed.

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

2.2 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information as applicable concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial Completions and occupancies.
19. Substantial Completions authorized.

B. 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.

2.3 SPECIAL REPORTS

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

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report.

List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At weekly 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. When revisions are made, distribute updated schedules to the same parties. 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.
4. Division 01 Section "Quality Requirements" for submitting test and inspection reports.
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. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
8. Division 01 Section "Integrated Deliverables and Testing (IDAT)" for submitting plan, checklists, schedules and reports.
9. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
10. 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 requested by the Owner’s 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.

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; 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.

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.

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 01 Section "Construction Progress Documentation."

G. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 01 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.

K. IDAT: Prepare IDAT Plan, checklists, schedule and reports in accordance with Division 01 Section "Integrated Deliverables and Testing (IDAT)."

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.

B. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

C. 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.

D. 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.

E. 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.

F. 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.

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

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

I. 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.

J. 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.

K. 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.

L. 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.

M. 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.

N. 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. Coordinate with Division 01 Section “Integrated Deliverables and Testing (IDAT)” requirements.

O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

P. 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.

Q. 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.

R. 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.

S. Material Safety Data Sheets (MSDSs): Submit information directly to Owner at end of the project. Maintain copy at the site for the duration of the construction.
   1. Architect will not review MSDS submittals 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.
   a. 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 01 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 construction schedule.

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 to the Architect.

C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it.

D. The 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.

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 may 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. 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. Division 01 Section “Integrated Deliverables and Testing (IDAT)” for additional requirements for checklists, monitoring, schedules, reports and coordination requirements.
4. 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. 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.

E. 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 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. 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.

F. 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.

1.6 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. 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.

D. 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

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

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

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

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

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

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

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

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

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

1.3 INDUSTRY STANDARDS

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

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

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

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

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Thomson Gale's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."

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

{ PRIVATE tbl1**}**

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

	www.afandpa.org	(202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, andRefrigeration Institute, The www.ahrinet.org	(703) 524-8800
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association	(202) 207-0917

	www.asphaltroofing.org	
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International (American Society of Mechanical Engineers International) www.asme.org	(800) 843-2763 (973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010

BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association www.canelect.ca	(613) 230-9263
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	 (703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175

CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200 (800) 328-6306
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute www.dhi.org	(703) 222-2010
ECA	Electrical Components Association www.ec-central.org	(703)907-8024
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee http://content.asce.org/ejcdc/	(703) 295-6000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek-etlsemko.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation)	41 22 545 00 00

	www.fiba.com	
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208
GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI) www.ahrinet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900

HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAPSC	International Association of Professional Security Consultants www.iapsc.org	(515) 282-8192
ICBO	International Conference of Building Officials www.iccsafe.org	(888) 422-7233
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
ICPA	International Cast Polymer Association www.icpa-hq.org	(703) 525-0320
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society of North America www.iesna.org	(703) 525-0320
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc. www.iliai.com	(812) 275-4426
ISA	Instrumentation, Systems, and Automation Society, The www.isa.org	(919) 549-8411
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (801) 341-7360
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11

KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LGSEA	Light Gauge Steel Engineers Association www.arcat.com	(202) 263-4488
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613
NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926

NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 222-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890
NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority	(604) 524-2393

	www.nlga.org	
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.org	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
PTI	Post-Tensioning Institute www.post-tensioning.org	(248) 848-3180
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	(706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	(925) 935-1499
SAE	SAE International	(877) 606-7323

	www.sae.org	(724) 776-4841
SCAQMD	South Coast Air Quality Management District www.aqmd.com	(909) 396-2000
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630

SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265
SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association www.swpa.org	(847) 681-1868
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association www.tema.org	(914) 332-0040
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463

WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122
WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

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

{ PRIVATE tbl2**}**

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

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

{ PRIVATE tbl3**}**

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220
EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science http://www.hhs.gov/ophs/	(202) 690-7694

RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772
USPS	Postal Service www.usps.com	(202) 268-2000

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

{ PRIVATE tbl4**}**

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253
	Architectural Barriers Act (ABA)	(202) 272-0080
	Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	
CFR	Code of Federal Regulations	(866) 512-1800
	Available from Government Printing Office	(202) 512-1800
	www.gpoaccess.gov/cfr/index.html	
DOD	Department of Defense Military Specifications and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification	(215) 697-2664
	Available from Department of Defense Single Stock Point	

	http://dodssp.daps.dla.mil/	
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration	(202) 619-8925
	www.gsa.gov	
	Available from National Institute of Building Sciences	(202) 289-7800
	www.wbdg.org/ccb	
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards	(215) 697-2664
	Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	
UFAS	Uniform Federal Accessibility Standards	(800) 872-2253
	Available from Access Board	(202) 272-0080
	www.access-board.gov	

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

{ PRIVATE tbl5**}**

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation	(800) 952-5210
	www.dca.ca.gov/bhfti	(916) 574-2041
CCR	California Code of Regulations	(916) 323-6815
	www.calregs.com	
CDHS	California Department of Health Services	(916) 445-4171
	www.dhcs.ca.gov	
CDPH	California Department of Public Health, Indoor Air Quality Section	

	www.cal-iaq.org	
CPUC	California Public Utilities Commission	(415) 703-2782
	www.cpuc.ca.gov	
TFS	Texas Forest Service Forest Resource Development	(979) 458-6606
	http://txforestservice.tamu.edu	

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

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 01 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. Water service.
2. Sanitary facilities, including toilets.
3. Heating.
4. Cooling.
5. Ventilation.
6. Electric power service.
7. Lighting.
8. Telephone service.
9. Internet service.

C. Support facilities include, but are not limited to, the following:
1. Waste disposal facilities.
2. Construction aids and miscellaneous services and facilities.

D. Security and protection facilities include, but are not limited to, the following:
1. Security enclosure and lockup.
2. Temporary enclosures.
3. Temporary dust protection.
4. 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 Work in the existing building.
1. Use of existing power for welding operations and for temporary heating will not be permitted.

1.4 QUALITY ASSURANCE

A. 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. 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 when the facility is not in use unless agree to otherwise in writing by the Owner. Obey State and local noise ordinances.

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. 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. Electrical Service: Provide required power chords and connect to existing outlets.

C. Sanitary Facilities:
   1. Toilets: Use of Owner’s existing toilet facilities at a designated location will be permitted. Contractor shall police area and maintain in a clean condition.

D. 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 wall and roof openings.
   1. Maintain cooling in the Computer Room for the duration of the Contract.

E. 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.

F. Telephone Service: Provide cellular telephone service with voice mail throughout construction period.

G. Internet Service: Wireless internet connection is available at the site. Coordinate access and use with Owner.

3.3 SUPPORT FACILITIES INSTALLATION

A. Construction and Demolition Waste Disposal Facilities: Provide waste-collection dumpsters and containers in sizes adequate to handle waste from construction 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.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of the building. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.

B. Temporary Dust Protection:
   1. Provide temporary dust protection isolating the work from equipment and occupied spaces before starting any demolition and remove after work is completed. Obtain approval from Architect before removal of protection.
      a. Coordinate installation of dust protection with temporary cooling to assure equipment is not isolated from cooling system, causing equipment to overheat.
   2. Temporary dust protection shall be fire-retardant vinyl and adequately supported sealed with duct tape. Supports shall be nonflammable.
   3. Provide access doors with perimeter seals where required to access the work. Provide walk-off mats at door openings to reduce spread of dust and dirt into the computer equipment area.

C. 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. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
   2. Develop and supervise an overall fire-prevention and fire-protection program for personnel at Project site. Review needs with Owner and local fire department and establish procedures to be followed. 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, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
   2. Snow removal: Provide snow removal necessary to do the work and maintain access to temporary facilities.

C. Flooring Protection: Protect 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 flooring with undyed, untreated building paper and required protection at high traffic 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. Owner reserves right to take possession of Project identification signs.
   2. Remove materials contaminated with oil and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks damaged during construction operations as required by authorities having jurisdiction.

3. 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 "References" for applicable industry standards for products specified.
   2. Division 01 Section “Substitutions and Product Options” for procedures and requirements for product substitutions.
   3. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
   4. 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 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.

1.5 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.

1.6 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 01 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 2PRODUCTS (Not Used)

PART 3EXECUTION (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 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 Utilities: The existence and location of utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground 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. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
4. Maintain minimum headroom clearance of 8 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: 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.

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 01 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 01 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 01 Section "Selective Structure Demolition" 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.
   3. Division 07 Section "Through-Penetration Firestop Systems" for patching fire-rated construction.

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.
   9. Operating systems of special construction.

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. 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 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 "Integrated Deliverables and Testing (IDAT)" for submitting, checklists, schedules and reports.
   3. Division 01 Section "Execution Requirements" for progress cleaning of Project site.
   4. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
   5. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   6. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
   7. 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. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
   3. 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.
   4. Prepare and submit Project Record Documents, operation and maintenance manuals. Submit final checklists, schedule and reports in accordance with the document titled “Integrated Deliverables and Testing (IDAT).” Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
   5. Complete startup testing of systems.
   6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
   7. Complete final cleaning requirements, including touchup painting.

8. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

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 01 Section "Payment Procedures."
   2. Submit 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 Perform 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.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
   1. Submit final warranties as a package for the entire project, assembled and identified.
   2. Electronic Media: Submit copy of warranty binder on CD-R in .PDF format. Bookmark based on the table of contents, and for each warranty within each section.

D. Provide additional electronic media copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: 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 interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. 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 made dirty from construction operations, removing debris and excess nap; shampoo if visible soil or stains remain.
    j. Resilient flooring made dirty from construction operations shall be scrubbed and cleaned with cleaner recommended by the flooring manufacturer just prior to occupation by Owner.
    k. Remove labels that are not permanent.
    l. 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.
    m. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    n. Leave Project clean and ready for occupancy.

C. Comply with safety standards for cleaning. Do not burn waste materials. 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

1.1 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 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.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 SUBMITTALS

A. Initial Submittal: Submit 1 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 and forward to Owner for comment. Architect will return draft and mark whether general scope and content of manual are acceptable.

B. Final Submittal: Submit one copy of each manual in final form at least 15 days before final inspection. Architect will return copy with comments after final inspection.
   1. Correct or modify each manual to comply with Architect's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's comments.

1.5 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

2.1 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."

2.2 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.

2.3 EMERGENCY OPERATIONS

A. Content: Emergency information that must be immediately available during emergency situations to protect life and property and to minimize disruptions to building occupants. Include information in operations manual into a separate section of the operations manual for each of the following:
   1. Type of emergency.
   2. Emergency instructions.
   3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
   1. Fire.
   2. Flood.
   3. Gas leak.
   4. Water leak.
   5. Power failure.
   6. Water outage.
   7. System, subsystem, or equipment failure.
   8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:
   1. Instructions on stopping.
   2. Shutdown instructions for each type of emergency.
   3. Operating instructions for conditions outside normal operating limits.
   4. Required sequences for electric or electronic systems.
   5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: 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.

2.5 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.

2.6 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

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
   1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
   2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
   1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
   1. Do not use original Project Record Documents as part of operation and maintenance manuals.

G. Comply with Division 01 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.
   5. Record IDAT Documents.

B. Related Sections include the following:
   1. Division 01 Section "Closeout Procedures" for general closeout procedures.
   2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
   3. 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 of marked-up Record Prints and one copy on electronic media
         1) Electronic Media: CD-R.

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. Record IDAT Documents: Submit one hard copy and one copy on electronic media of IDAT plan and submittals.

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.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether Record Product Data has been submitted in operation and maintenance manuals instead of submitted as Record Product Data.
5. Note related Change Orders, 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 RECORD IDAT DOCUMENTS

A. Electronic Media: Submit record copy of IDAT documents on CD-R in .PDF format. Assemble documents with Bookmarks for IDAT Plan and each final Installation Checklist. With each Installation Checklist, include corresponding Certificates of Readiness, Corrective Action Reports and all other related reports and documentation.

2.5 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

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. Demonstration and Training: Submit list of systems and equipment to be demonstrated and training provided.

1.4 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

A. Provide demonstration and training for each system and equipment, as required by individual Specification Sections, and applicable items as follows:
   1. Generator.
   2. UPS system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training.

3.2 DEMONSTRATION AND TRAINING INSTRUCTION

A. Engage qualified personnel to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment.
   1. Owner will furnish Contractor with names and positions of participants.

B. Scheduling: Provide demonstration and training 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.

C. Demonstration and Training: Provide instruction for equipment and systems operation. Include instruction as applicable for the following:
   1. 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 manuals.
      b. Maintenance manuals.
      c. Project Record Documents.
      d. Identification systems.
      e. Warranties and bonds.
      f. Maintenance service agreements and similar continuing commitments.
   3. Emergency Operation Procedures: 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. Startup procedures.
      b. Equipment or system break-in procedures.
      c. Routine and normal operating instructions.
      d. Regulation and control procedures.
      e. Control sequences.
      f. Safety procedures.
      g. Instructions on stopping.
      h. Normal shutdown instructions.
      i. Operating procedures for emergencies.
      j. Operating procedures for system, subsystem, or equipment failure.
      k. Seasonal and weekend operating instructions.
      l. Required sequences for electric or electronic systems.
      m. Special operating instructions and procedures.
   5. Adjustments: Include the following:
      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.

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

ID	Trainer	Company	Position / Qualifications
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_____

Agenda of general subjects covered (√ all that will be covered) (√)	Duration (√ when completed)	Instructor (min.)	Completed (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.
4. Division 01 Section "Testing, Adjusting and Balancing" for specific requirements for commissioning HVAC systems.

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, controls for HVAC systems, and other related systems.

B. CxA: Commissioning Agent hired by Owner.

C. CC: Controls Contractor/Subcontractor.

D. CM: Construction Manager/(General) Contractor.

E. EC: Electrical Contractor/Subcontractor.

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/Subcontractor.

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 Agent/Agency.

1.4 IDAT TEAM RESPONSIBILITIES

A. The members of the IDAT team consists primarily of the CM, PM, PO, A/E (particularly the electrical engineer), the electrical subcontractor, TAB representative, any other installing subcontractors or suppliers of equipment.

B. General description of the IDAT responsibilities are as follows:
1. A/E: Perform construction observation; review 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, integrates IDAT into the construction process, and coordinates 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 10 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, Mechanical Commissioning Agent 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 02 thru 33 sections and procedures described in Division 01 Section "Quality Requirements" are separate from the IDAT process. In some cases, the verification of these tests may be included in the prefunctional/preinstallation checklist to verify completion of a system before it is incorporated and made inaccessible by the Work.

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 occur 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 the 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.

E. Extra Materials List: Prepare list of extra materials (spares) required in the Division 02 thru 33 sections. List shall include the following:
1. Section number.
2. Name and identification of item.
3. Quantity required.

1.7 SUBMITTALS

A. IDAT Plan Initial Submittal: CM shall submit two hard copies of prefinal IDAT 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 IDAT plan.

B. IDAT Plan Final Submittal: CM shall submit two hard copies and two sets of electronically formatted information of final IDAT plan. Deliver one hard copy and one set of discs to Owner, and one copy to Architect. The final submittal shall 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 checklists and report forms. 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 Division 01 Section “Project Record Documents” for preparation of complete record of submittals for project record documents.

G. Extra Material List: Submit list.

1.8 COORDINATION

A. CoordinationMeetings: 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. Prefunctional Meetings: CM shall conduct prefunctional 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
   1. Demolition and Construction:
      a. Prefunctional / Preinstallation Checklist
         1) Coordination meeting with Architect, Owner and Contractors.

2) Preconstruction walk through and documentation of existing conditions.
3) Review of materials to be salvaged.
4) Protection of existing facility from damage from demolition and construction operations.
5) Coordination and field measurements of existing conditions and new equipment requirements for metal fabrications.
6) Verification of locations, heights and clearances for mechanical and electrical work.

b. Functional Performance Test / Post-installation Checklist
1) Verify installation of metal fabrications for proper attachment to structure.
2) Verify that firestopping has been properly installed and permanent identification labels are in place adjacent to each firestopped penetration.
3) Verify openings, cable penetrations, cracks and holes are properly sealed such that the specified fire suppression agent concentration is maintained in the hazard area for a minimum of ten minutes after completion of the initial agent discharge.
4) Verify interior work areas have been properly cleaned.
5) Verify exterior site work is complete and the grounds properly cleaned.
6) Verify interior and exterior areas have been inspected with the Owner for damage caused by construction operations

2. Ceilings
a. Prefunctional / Preinstallation Checklist
1) Work above ceiling is complete, including:
a) Duct work, dampers, diffusers.
b) Fire suppression and detection system.
c) Conduit, piping, cabling.
d) Fire stopping.
e) Safety hanger wire supports for fixtures installed and light fixture installation complete.

b. Functional Performance Test / Post-installation Checklist
1) Grid hangers properly spaced and hung from structure.
2) Ceiling tile and grid inspected for marks and damage.

3. Painting
a. Prefunctional / Preinstallation Checklist
1) Adequate lighting levels available for visual inspections and application.
2) Inspect walls for dents and imperfections, with gypsum board installer and painter.
3) Gypsum board touch up of dents and imperfections completed.
4) Rooms are broom clean, surfaces have been dusted, including wall surface, ledges, sills, tops of door frames.
5) Cover plates removed.

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) Cover plates installed.

4. Fire Supression and Detection
a. Refer to Division 21.
b. Prefunctional / Preinstallation Checklist
1) Coordination meeting with Architect, Owner and Contractors.

2) Owner's Insurance Underwriter's approval has been obtained before start of the fire suppression work.
3) Process to maintain record drawings as the work progresses is coordinated.

c. Functional Performance Test / Post-installation Checklist
1) Verify warning signs, tags and labels are in place for equipment, conductors. valves and piping.
2) Verify supports are properly anchored, connections are tight.
3) Visually inspect piping and equipment for proper and complete installation, supports are properly anchored and connections are tight.
4) Verify line voltage power supply is in separate conduit and connected to dedicated circuit.
5) Verify completion of fire suppression system functional test with system checklist and written summary of functional tests conducted.
6) Verify completion of smoke detection system commissioning and written report of system commissioning and tests.
7) Verify a copy of each instruction manual is located in an accessible location in the vicinity of system control panel.
8) Verify completion of Owner training session.
9) Spares and extra materials furnished to Owner.

5. HVAC and Plumbing
a. Refer to Division 21 and 23.
b. Prefunctional / Preinstallation Checklist
1) Coordination meeting with Architect, Owner and Contractors.
2) Process to maintain record drawings as the work progresses is coordinated.
3) Cooling of computer room maintained until new air conditioner is operational.
4) Fire stopping for penetrations through fire rated construction has been identified and proper firestopping system has been submitted for each condition.
5) Openings through existing construction are adequate for proper installation of mechanical items.
6) Verify connections are tight and bolts properly torqued.
7) Inspect piping, ductwork and equipment for proper installation and completeness before covering with insulation.

c. Functional Performance Test / Post-installation Checklist
1) Verify piping and equipment nameplates, tags, stencils and pipe markers are in place.
2) Verify supports are properly anchored, connections are tight and bolts properly torque.
3) Visually inspect piping, equipment and duct insulation for proper and complete installation of vapor barriers, jackets, shields, inserts and brackets.
4) Verify piping pressure testing is complete and reports submitted for all piping including supply, waste, hydronic steam and refrigerant piping.
5) Verify ductwork complies with material and pressure class schedules.
6) Verify installation of air duct accessories and operation of dampers.
7) Verify line voltage and phase and direction of rotation for motors, and ensure agreement with nameplate. Verify guards and protection are in place.
8) Verify completion of TAB with field and test reports submitted.
9) Verify completion of air conditioner start up and functional testing.

10) Verify completion of instrumentation and controls inspections and tests with field and test reports submitted.
11) Verify that firestopping has been properly installed and permanent identification labels are in place adjacent to each firestopped penetration.
12) Spares and extra materials furnished to Owner.

6. Electrical.
   a. Refer to Division 26.
   b. Prefunctional / Preinstallation Checklist
      1) Coordination meeting with Architect, Owner and Contractors.
      2) Process to maintain record drawings as the work progresses is coordinated.
      3) Type, location and appearance of surface raceways and wireways have been reviewed with the Owner and approved before installation.
      4) Fire stopping for penetrations through fire rated construction has been identified and proper firestopping system has been submitted for each condition.
      5) Onsite walk through with Owner has been conducted, with panels, circuits, and timing of shut downs identified and coordinated with Owners operations.
      6) Verify existing electrical circuits affected by the work are shut down and properly identified.
      7) Verify existing abandoned conduits to remain are properly terminated with pull strings.
      8) Verify that all panels, boxes and conduits are installed. Conduits clean, dry, with ends properly terminated, free of conditions that might cause damage to wires.
      9) Verify that all line voltage circuits are in place ready for termination.
      10) Check transformer for damage and tight connections prior to energizing.
      11) Panel backboards are in place and secure, ready to receive panels.
      12) Verify typed directory completely filled-in indicating outlets, fixtures, devices, and locations served by the circuit.
   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.
      3) Inspect wire and cable for physical damage.
      4) Verify tightness of bolted connections are measured and torque measurements compared with manufacturer's recommended values.
      5) Verify that firestopping has been properly installed and permanent identification labels are in place adjacent to each firestopped penetration.
      6) Test the entire installation and verify that system is free from short circuits and improper grounds.
      7) Test feeders with the feeders disconnected from the branch circuit panels.
      8) Test each individual branch circuit at the panel.
      9) Test wiring devices for proper operation, grounding and polarity.
      10) Electrical identification is in place including proper nameplates and tape labels, wire cables and markers and conductor color coding.
      11) Measure transformer primary and secondary voltages and make appropriate tap adjustments.
      12) Visual inspection of panel boards complete. Steady state load currents measured and circuits rearranged to balance the phase loads as required.
      13) Verify luminaires function properly and lamps are working.
      14) Spares and extra materials furnished to Owner.

7. Static Uninterruptable System
    a. Refer to Section 260611.
    b. Prefunctional / Preinstallation Checklist
        1) Pre-installation and coordination meeting with Architect, Owner, UPS Equipment Factory Representative, and Contractors.
        2) Review contact information for equipment service and parts.
        3) Process to maintain record drawings as the work progresses is coordinated to record conduit runs and equipment locations.
        4) Verify equipment layout and locations, and existing conditions.
        5) Review access and conduit runs from power sources to data room.
        6) Verify that all panels, boxes and conduits are installed.
        7) Verify factory service personnel have performed visual, mechanical, and electrical inspections are completed before system start-up and report submitted.
    c. Functional Performance Test / Post-installation Checklist
        1) UPS system tests have been completed and test results documented and submitted.
        2) Demonstration and training is complete.

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 place of the requirements contained in the contract documents.
- 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 is to verify completion of this item. All = all contractors, GC = general contractor, IC = 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:

Sample

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.
Prefunctional / Pre-installation Checklist						
Blocking complete						
Sheathing in compliance with specified requirements						
Adjacent materials ready for A/V barrier installation						
Additional Checks:						
Functional Performance Test / Post-installation Checklist						
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 of 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:

Party	For review & comment only	For review & action	For record only
CM	____	____	____
Harriman	____	____	____
USM, Dana A. Gray	____	____	____
USM, ***TBD***	____	____	____
USM, ***TBD***	____	____	____
	____	____	____
	____	____	____

Corrective Action Report

Fill in the following section and return entire form to USM PM agent when corrected.

Statement of Correction

The above deficiencies have been corrected with the following actions:

_____
_____
_____
_____
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_____

_____ _____ _____

Signature Firm Date

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 building or structure.
   2. Repair procedures for selective demolition operations.

B. Related Sections include the following:
   1. Division 01 Section "Summary" for use of premises and Owner-occupancy requirements.
   2. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
   3. Divisions 21, 22 and 23 Sections for additional requirements regarding demolishing, cutting, patching, or relocating mechanical items.
   4. Division 26 Sections for additional requirements regarding demolishing, cutting, patching, or relocating electrical items.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction and deliver them to Owner.

C. Remove and Reinstall: Detach items from existing construction; clean, service, and otherwise prepare them for reuse; store and protect against damage. Reinstall them where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled. Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by 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 salvaged, reused, reinstalled, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

1.5 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. 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. Use of elevator and stairs.
5. Locations of proposed dust- and noise-control temporary partitions and means of egress. Indicate the proposed time frame for their operation.
6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
7. Means of protection for items to remain and items in path of waste removal from building.

C. Predemolition Photographs or Videotapes: Show existing conditions of adjoining construction and improvements, including finish surfaces, that might be misconstrued as damage caused by selective demolition operations. Submit before Work begins.

1.6 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI A10.6 and NFPA 241.

C. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 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 requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.
6. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.
7. Provide 72-hour minimum advance notice to participants prior to convening predemolition conference.

1.7 PROJECT CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
1. Comply with requirements specified in Division 01 Section "Summary."
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. 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. Owner will remove hazardous materials under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. 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 Architect.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or preconstruction videotapes.

F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems: Maintain services/systems 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 and 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. Service/System Requirements: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Owner will arrange to shut off indicated services/systems when requested by Contractor.
   2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems 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.
      a. Where entire wall is to be removed, existing services/systems may be removed with removal of the wall.

C. Utility Requirements: Refer to Division 22, 23, and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utility services. 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. Comply with requirements for access and protection specified in Division 01 Section "Temporary Facilities and Controls."

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.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Division 01 Section "Temporary Facilities and Controls."

C. Furniture Removal:
   1. At Minor Renovation Areas and Access for Mechanical, Electrical and Sprinkler: Contractor shall move furniture out of the way and cover furniture, shelving and equipment with 4 mil polyethylene to protect from dust and dirt. Prevent workers from stepping and standing on casework, shelving and furniture. The Owner will remove books and papers from shelves requiring relocation.

3.4 POLLUTION CONTROLS

A. Dust Control: Use temporary enclosures, and other suitable methods to limit spread of dust and dirt.

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, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. 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 after until chance of fire has past.
   5. Core drilling: Colleect water and prevent damage to existing facilities.
   6. Maintain adequate ventilation when using cutting torches.
   7. Remove decayed, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
   8. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   9. 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.

10. Return elements of construction and surfaces to remain to condition existing before start of selective demolition operations.

B. Reuse of Building Elements: Do not demolish building elements beyond what is indicated on Drawings without Architect's approval.

C. Removed and Salvaged Items:
1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.6 PATCHING AND REPAIRS

A. General: Promptly repair damage to adjacent construction caused by selective demolition operations.

B. 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.

C. Repairs: Where repairs to existing surfaces are required, patch to produce surfaces suitable for new materials.

D. Finishes: Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.

E. 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 and wall 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.

F. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
a. On-site storage or sale of removed items is prohibited.

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.8 CLEANING

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

END OF SECTION 024119

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 framing and supports for the following:
      a. Roof top grillage and supports.
      b. Access floor supports at UPS.
   2. Miscellaneous fabrications.

1.3 PERFORMANCE REQUIREMENTS

1.4 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "General Requirements."

B. Shop Drawings: Show fabrication and installation details for metal fabrications.
   1. Include plans, elevations, sections, details and connection. Show anchorage and accessory items.
   2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
   3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts.

C. Welding Certificates: Signed by Contractor certifying that welders comply with requirements specified under the "Quality Assurance" Article.

D. 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."

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.

B. Steel Tubing: Product type (manufacturing method) and as follows:

1. Cold-Formed Steel Tubing: ASTM A 500.
2. Hot-Formed Steel Tubing: ASTM A 501.

C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.

2.3 FASTENERS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts; ASTM A 563 (ASTM A 563M) heavy hex carbon-steel nuts; and ASTM F 436 (ASTM F 436M) hardened carbon-steel washers.
1. Finish: Hot-dip zinc coating, ASTM A 153/A 153M, Class C for exterior use.

B. 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. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements of FS TT-P-664, selected for good resistance to normal atmospheric corrosion, compatibility with finish paint system indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

D. 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. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Shop Assembly: Preassemble items in shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

C. 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.

D. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

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. Locate joints where least conspicuous.

H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.6 MISCELLANEOUS GRILLAGE, FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated that are not specified in other Sections as needed to complete the Work.

B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
   1. Exterior Grillage and Supports: Hot dip galvanized.

C. Galvanize miscellaneous framing and supports at exterior locations.

D. Prime interior fabrications.

2.7 ROUGH HARDWARE

A. Furnish bent, or otherwise custom-fabricated, bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required.

2.8 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Finish metal fabrications after assembly.

2.9 STEEL AND IRON FINISHES

A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dip process, 0.05 - 0.09% nickel content, Duragalv 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.
   3. Galvanizing shall exhibit a rugosity (smoothness) not greater than 4 rug (16-20 microns of variation) when measured by a profilometer over a 1-inch straight line on the surface of architectural and structural elements that are less than 24 pounds per running foot. Profilometer shall be capable of operating in 1 micron increments.

B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
   1. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."

C. Shop Priming – Interior Fabrications: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
   1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are 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, through bolts, and other connectors.

E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

3.3 ADJUSTING AND CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

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. Wood blocking and nailers.
   2. Plywood sheathing.
   3. Plywood backing panels.

PART 2 - PRODUCTS

2.1 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. Hem-fir (north); NLGA.
   2. Mixed southern pine; SPIB.
   3. Spruce-pine-fir; NLGA.
   4. Hem-fir; WCLIB, or WWPA.
   5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.2 PLYWOOD

A. Plywood (Concealed Applications): [Exposure 1, C-D sheathing.
   1. Nominal Thickness: Not less than 5/8 inch(15.8 mm), except as otherwise noted.
   2. Species: Fir.

2.3 PLYWOOD BACKING PANELS

A. 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 (12.7 mm) nominal thickness.
   1. Mount on fire retardant treated framing lumber.
   2. Paint: Paint backer board with flat black latex paint.

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.

3.2 BACKBOARDS

A. Securely attach wood supports to walls with anchors as required for wall type and conditions. At framed walls, fasteners shall attach to stud framing. Screw attach plywood to wood support framing. Plywood shall be one piece without joints for backboards that are smaller than 4 feet by 8 feet.
   1. Coordinate backboard size with electrical.
   2. Paint exposed fasteners, face and edges of plywood, and exposed edges of wood supports.

3.3 WOOD BLOCKING INSTALLATION

A. Install where indicated and where required for attaching other work. Install wood blocking and nailers to support construction and fixtures and miscellaneous items and construction. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated.

SECTION 075410 - SINGLE-PLY MEMBRANE ROOF PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Alterations and patching to the existing EPDM roofing system.
   2. Roof insulation infill at patches.
   3. Metal flashing.

B. Related Sections:
   1. Division 06 Section "Rough Carpentry" for wood blocking and nailers.

1.2 REFERENCES

A. NRCA: National Roofing Contractors Association

B. SPRI: Single Ply Roofing Industry

C. Membrane Manufacturers Installation Manual

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 SUBMITTALS FOR APPROVAL

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Shop Drawings: Submit shop drawings showing roof modification locations penetration and flashing details and special conditions.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product.

1.6 SEQUENCING

A. Coordinate roofing work with phasing or schedule of work. Provide weather tight closure around new penetrations as necessary to allow the work to proceed. Do not begin roof membrane installation until all penetrations have been extended to the proper height above roof deck and other trades no longer require access to the roof area.

B. Monitor roof mounted equipment and curb installation to maintain weatherproof conditions until complete membrane can be installed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. EPDM Sheet: Uniform, flexible sheet formed from EPDM, and as follows:
   1. Thickness: 0.060 inches, nominal.
   2. Exposed Face Color: Black.

2.2 COMPONENTS

A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   1. Liquid-type auxiliary materials shall meet VOC limits of authorities having jurisdiction.

B. Sheet Flashing: Manufacturer's standard sheet flashing of same material, thickness, type, reinforcement, and color as EPDM sheet membrane.

C. Bonding Adhesive: Manufacturer's standard bonding adhesive for EPDM membrane, and solvent-based bonding adhesive for base flashings.

D. Metal Flashing Termination Bars: Manufacturer's standard predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors. Supplied by membrane manufacturer to be used on vertical wall applications between roof deck surface and wall coping detail. Bar to be placed at maximum 48 inches on center. 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. 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.

2.3 ACCESSORIES

A. Sheet Metal Cap: Zinc-Coated Steel; Commercial quality with 0.20 percent copper, ASTM A 526 except ASTM A 527 for lock-forming, G90 hot-dip galvanized, 24 gauge. Form to detail, providing weather tight cap.
   1. Comply with SMACNA fabrication and installation requirements.

B. Insulation Board for Infill: To match existing in type and thickness.

C. Insulation Accessories
   1. Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

2. Fasteners: Factory-coated steel fasteners and metal or plastic plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening roof insulation to substrate, and acceptable to roofing system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with the following requirements and other conditions affecting performance of roofing system:
   1. Verify that roof openings and penetrations are in place and set.
   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.
   3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing installation according to roofing system manufacturer's written instructions in manner that will not create or contribute to environmental hazard. Remove sharp projections, nails, screws or metal pieces.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. 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 INSULATION INSTALLATION

A. Coordinate installing membrane roofing system components so insulation is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof insulation.
   1. Install two layers of insulation under area of roofing to achieve required thickness
   2. Fill gaps exceeding 1/4 inch with insulation.
      a. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
   3. Secure insulation to deck using mechanical fasteners.

3.4 ROOFING MEMBRANE INSTALLATION

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 and penetrations,.

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 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 dry until tacky-to-dry to the touch. 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. Adhere 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.

F. Screw attach sheet metal cap to curb, providing air tight, weather tight seal.

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.

END OF SECTION 075410

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: Maintaining smoke and fire rating in existing vertical and horizontal surfaces for the following
   1. Penetrations in fire-resistance-rated walls.
   2. Penetrations in horizontal assemblies.
   3. Penetrations in smoke barriers.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated. Include installation instructions.

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

1.4 QUALITY ASSURANCE

A. Installation Responsibility: Assign installation of through-penetration firestop systems and fire-resistive joint systems in Project to a single qualified installer.

B. Fire-Test-Response Characteristics: Penetration firestopping shall comply with the following requirements:
   1. Penetration firestopping tests are performed by a qualified testing agency acceptable to authorities having jurisdiction.

2. Penetration firestopping is identical to those tested per testing standard referenced in "Penetration Firestopping" Article. Provide rated systems complying with the following requirements:
    a. Penetration firestopping products bear classification marking of qualified testing and inspecting agency.
    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."

C. 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."

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 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. 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 similar type utility 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 walls, 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 floorsfloor/ceiling assembliesceiling membranes of roof/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 to40 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.
   4. Other: 750 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, UL system number and date.
   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. 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.

C. Proceed with enclosing penetration firestopping with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping manufacturers and that do not damage materials in which openings occur.

B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping is without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping and install new materials to produce systems complying with specified requirements.

END OF SECTION 078413

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. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
      a. Perimeter joints between interior wall surfaces and adjacent construction.
      b. Foam sealant at non-rated cracks, holes and joints at perimeter walls of computer room.
      c. 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 09 Section "Gypsum Board Assemblies" for sealing perimeter joints of new gypsum board partitions to reduce smoke transmission.
   3. Divisions 22, 23, and 26 for sealing of perimeter joints of plumbing, HVAC systems, automatic fire protection systems, and electrical systems.

1.3 PERFORMANCE REQUIREMENTS

A. Provide joint sealants that have been produced and installed to establish and to maintain watertight and airtight continuous seals without causing staining or deterioration of 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.

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 PROJECT CONDITIONS

A. Joint Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer, based on testing and field experience.

B. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

C. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 JOINT SEALANTS

A. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C834, single component, paintable.
   1. Tremco Acrylic Latex; Tremco.
   2. AC-20; Pecora Corporation.
   3. Chem-Calk 600; Bostik Findley.

B. Foam-In-Place Insulation: On-site foam-in-place insulation shall be Class 1 foam’
   1. Froth-Pac 1.75-25 FS; Insta-Foam Products, Inc.
   2. Touch 'n Foam Gun Foam Sealant; Convenience Products.

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.

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.

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 sealant backings.
      b. Do not stretch, twist, puncture, or tear sealant backings.
   2. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and joint fillers or 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 INSTALLATION OF FOAM-IN-PLACE INSULATION

A. Install foam-in-place insulation sealant to a minimum depth of 1 inch, sealing deck flutes and construction cracks and gaps at perimeter walls of Computer Room 237, providing a tight envelope for proper function of Inergen System.

3.5 CLEANING

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

3.6 PROTECTION

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

END OF SECTION 079200

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. Non-load-bearing steel framing.
   3. Acoustical insulation in metal-framed assemblies.
   4. Acoustical sealant.

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.

1.5 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.

C. Stack gypsum panels flat on leveled supports off floor or slab to prevent sagging.

1.6 PROJECT CONDITIONS

A. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 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 NON-LOAD-BEARING STEEL FRAMING, GENERAL

A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
   1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
   2. Protective Coating: ASTM A 653/A 653M, G40 (Z120), hot-dip galvanized, unless otherwise indicated.

2.3 STEEL PARTITION AND SOFFIT FRAMING

A. Manufacturers:
   1. Dale Industries, Inc. - Dale/Incor.
   2. Dietrich Industries, Inc.
   3. MarinoWare; Division of Ware Ind.
   4. National Gypsum Company.

B. Steel Studs and Runners: ASTM C 645.
   1. Minimum Base Metal Thickness: minimum 0.027 inch (22gage) minimum, unless otherwise indicated.
   2. Depth: 3-5/8 inches (field verify and match existing).

C. 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.

D. 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 the recommendations of gypsum board manufacturers for applications indicated.

2.4 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

B. Manufacturers:
   1. G-P Gypsum Corporation.
   2. National Gypsum Company.
   3. United States Gypsum Company.

2.5 INTERIOR GYPSUM WALLBOARD

A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.

B. Type X, GPDW:
   1. Thickness: 5/8 inch.
   2. Long Edges: Tapered.
   3. Location: All locations, except as otherwise noted.

2.6 TRIM ACCESSORIES

A. Interior Metal 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.

2.7 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.

2.8 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 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 recommended for sealing interior concealed joints to reduce airborne sound transmission.

2.9 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.
   2. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.

C. Sound Attenuation Blankets (Acoustical Insulation): ASTM C 665, Type I (blankets without membrane facing) 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. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
   2. Manufacturers:
      a. Certainteed.
      b. Owens Corning.
      c. Johns Manville.

D. Insulation Support Anchors: Insul-Fast 25 gauge galvanized continuous metal support strip with pre-punched tabs at 8 inches on center.

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.

3.2 STEEL FRAMING INSTALLATION, 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, equipment services, 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.

3.3 INSTALLING STEEL PARTITION 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 and furring 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.

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. Installation Tolerance: Framing members shall be within the following limits:
   1. Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing, a total variation of 1/4 inch in 8 feet from a true plane.
   2. Layout of Walls and Partitions: 1/4 inch from intended position.
   3. Plates and Runners: 1/4 inch in 10 feet from a straight line.

4. Studs: 1/4 inch in 10 feet out of plumb, not cumulative.
5. Headers and Sills of Openings: 1/8 inch from level across width of opening.
6. Soffits: 1/4 inch in 10 feet from level straight line.
7. Spacing of Framing Members: Comply with requirements of ASTM C 754.

3.4 INSTALLATION OF ACOUSTICAL INSULATION

A. Install acoustical insulation at locations indicated before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement. Install insulation in voids as framing is installed that that would be inaccessible after completion of framing.

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).

3.5 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 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.

D. Locate edge and end joints over supports. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Attachment to Steel Framing: Attach gypsum panels to steel studs so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

F. Attach gypsum panels to framing provided at openings and cutouts.

G. 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 commencement of work.

H. Cover both faces of steel stud partition framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Fit gypsum panels around ducts, pipes, and conduits.
2. Where partitions intersect beams, joists and other structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by beams, joists, and other structural members; allow 1/4- to 3/8-inch- wide joints to install sealant. Caulk smoke partitions and perimeter walls of Computer Room with acoustical sealant on both sides of wall. Run board to within 1/4 inch of floor slabs to provide full support of resilient base.

I. 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.

J. 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.

K. Remove screws that do not hit studs, supports, or blocking.

3.6 PANEL APPLICATION METHODS

A. Single-Layer Application:
1. 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.
2. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

B. Single-Layer Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.7 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.

3.8 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 2: At ceiling plenum areas, concealed areas.
   2. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.

E. 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.

F. 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 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.

3.9 CLEANING

A. Promptly remove any residual joint compound from adjacent surfaces.

3.10 PROTECTION

A. Protect installed products from damage from construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration. END OF SECTION 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 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Acoustical panels.
   2. Exposed suspension systems.

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 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 each acoustical panel ceiling.

1.4 QUALITY ASSURANCE

A. Source Limitations:
   1. Acoustical Ceiling Panel: Obtain panels through one source from a single manufacturer.
   2. Suspension System: Obtain suspension systems through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide acoustical panel ceilings that comply with the following requirements:
   1. Fire-Resistance Characteristics: Where indicated, provide acoustical panel ceilings identical to those of assemblies tested for fire resistance per ASTM E 119 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
      a. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
      b. Identify materials with appropriate markings of applicable testing and inspecting agency.
   2. Surface-Burning Characteristics: Provide acoustical panels with the following surface-burning characteristics complying with ASTM E 1264 for Class A materials as determined by testing identical products per ASTM E 84:
      a. Smoke-Developed Index: 450 or less.

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. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. 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 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 ACOUSTICAL PANELS, GENERAL

A. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances, unless otherwise indicated.
   1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface per ASTM E 795.
   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.

1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTIC PANELS

A. Acoustic Panel: ACT-1.
   1. Size: 24 inches x 24 inches x 5/8-inch thick.
   2. Composition: Mineral wool fiber.
   3. Surface Finish: Factory-applied latex paint; white.
   4. Surface Texture: Factory-applied latex paint; white.
   5. Edge: Square.
   6. NRC Range: .55.
   7. CAC Range: 35.
   8. Fire Hazard Classification: Class A, 0 - 25 flame spread.
   9. Product: Armstrong World Industries, Inc.; Cortega No. 770.
   10. Suspension System Type: A.

2.4 METAL SUSPENSION SYSTEMS, GENERAL

A. Metal Suspension System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635.

B. Finishes and Colors, General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes. Provide manufacturer's standard factory-applied finish for type of system indicated.

C. 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.

E. Hold-Down Clips: Provide manufacturer's standard hold-down clips spaced 24 inches o.c. on all cross tees of ceiling in Computer Room 237.

2.5 METAL SUSPENSION SYSTEMS FOR ACOUSTICAL PANEL CEILINGS

A. Type 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, XL 7300 Series.

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. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.

4. Secure wire hangers to ceiling suspension members and to supports above with a minimum of three tight turns. Connect hangers directly either to structures or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
6. Do not attach hangers to steel deck tabs.
7. Do not attach hangers to steel roof deck. Attach hangers to structural members.
8. 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.
9. 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.
4. Install hold-down clips in Computer Room 237 to prevent displacement of tile by the INERGEN system.

3.4 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096500 - RESILIENT BASE

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 resilient base.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each type of product indicated.

C. Samples for Initial Selection:
1. Resilient Base: Actual pieces of strips of resilient base showing full range of colors available for each product exposed to view.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver resilient 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 materials and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces and rolls upright.

1.5 PROJECT CONDITIONS

A. Install resilient base after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT WALL BASE

A. Resilient Base: ASTM F 1861.
1. Manufacturers:
a. Armstrong World Industries, Inc.
b. Johnsonite.
c. Roppe Corporation, USA.
2. Material Requirement: Type TS (rubber, vulcanized thermoset**)**.
3. Manufacturing Method: Group I (solid, homogeneous).
4. Style: Match existing.
5. Minimum Thickness: 0.125 inch.

6. Height: To match existing.
7. Lengths: Coils in manufacturer's standard length.
8. Outside Corners: Job formed.
9. Inside Corners: Job formed.
10. Colors and Patterns: To match existing.

2.2 INSTALLATION MATERIALS

A. Adhesives: Premium grade, water-resistant type recommended by manufacturer to suit wall base and substrate conditions indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. 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.

C. Do not install resilient base until it is same temperature as space where it is to be installed.
1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

D. 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.

3.2 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, and other permanent fixtures in rooms and areas where base is required. Where toe space is less than base height, cut down base to proper height.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. Job-Formed Corners:
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.

END OF SECTION 096500

SECTION 096900 - ACCESS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Access-flooring panels.
   2. Understructure.
   3. Floor panel coverings.

B. Related Requirements:
   1. Division 05 Section "Metal Fabrications" for supports at existing access flooring to support UPS and battery cabinets.
   2. Division 26 Sections for connection to ground of access-flooring understructure.

1.3 COORDINATION

A. Coordinate location of mechanical and electrical work in underfloor cavity to prevent interference with access-flooring pedestals.

B. Mark pedestal locations on subfloor using a grid to enable mechanical and electrical work to proceed without interfering with access-flooring pedestals.

1.4 SUBMITTALS

A. Product Data: For each type of product. Include manufacturer's installation instructions and guidelines.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 COORDINATION

A. Coordinate locations of openings and grommets in access flooring with work of electrical subcontractor.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Match existing.

B. Fire Performance:
   1. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.
   2. Combustion Characteristics: ASTM E 136.

2.2 FLOOR PANELS

A. Floor Panels, General: Provide modular panels interchangeable with other field panels without disturbing adjacent panels or understructure.
   1. Size: Nominal 24 by 24 inches.
   2. Attachment to Understructure: By gravity.
   3. Product: Match existing.

2.3 UNDERSTRUCTURE

A. Pedestals: Assembly consisting of base, column with provisions for height adjustment, and head (cap); made of steel.
   1. Match existing.

B. Stringer Systems: Modular steel stringer systems designed to bolt to pedestal heads and form a grid pattern. Protect steel components with manufacturer's standard galvanized or corrosion-resistant paint finish.
   1. Match existing.

C. Understructure Finish: Manufacturer's standard painted finish.

D. System Height: Match existing.

2.4 FLOOR PANEL COVERINGS

A. High-Pressure Plastic Laminate: Factory applied, NEMA LD 3, High-Wear type, Grade HDH; fabricated in one piece to cover each panel face with applied perimeter plastic edging.
   1. Match existing.

2.5 FABRICATION

A. Fabrication Tolerances:
   1. Size: Plus or minus 0.020 inch of required size.
   2. Squareness: Plus or minus 0.015 inch between diagonal measurements across top of panel.
   3. Flatness: Plus or minus 0.035 inch, measured on a diagonal on top of panel.

B. Panel Markings: Clearly and permanently mark floor panels on their underside with panel type and concentrated-load rating.

C. Cutouts: Fabricate cutouts in floor panels for cable penetrations and service outlets. Provide reinforcement or additional support, if needed, to make panels with cutouts comply with structural performance requirements.
   1. Number, Size, Shape, and Location: As indicated.

2. Grommets: Where indicated, fit cutouts with specified grommets. If size of cutouts exceeds maximum grommet size available, trim edge of cutouts with manufacturer's standard plastic molding with tapered top flange.
3. Provide foam-rubber pads for sealing annular space formed in cutouts by cables.

2.6 ACCESSORIES

A. Adhesives: Manufacturer's standard adhesive for bonding pedestal bases to subfloor.

B. Grommets: Raised floor grommet with brush closure to block airflow, protect cables and allow easy installation or removal of cables. Seal space around cables with two layers of brush closure:
1. Gromment Type: Integral, one-piece.
2. Cable Opening Size: 5 inches by 8 inches.
3. Quantity: Provide one gromment under each rack; coordinated location with equipment and electrical subcontractor.
4. Product: Chatsworth Products, Inc.; Koldlok Raised Floor Grommet or equivalent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer and manufacturer's representative present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Locate each pedestal, complete any necessary subfloor preparation, and vacuum subfloor to remove dust, dirt, and construction debris before beginning installation.

3.3 INSTALLATION

A. Install access-flooring system and accessories under supervision of access-flooring manufacturer's authorized representative to produce a rigid, firm installation that complies with performance requirements and is free of instability, rocking, rattles, and squeaks.

B. Adhesive Attachment of Pedestals: Set pedestals in adhesive, according to access-flooring manufacturer's written instructions, to provide full bearing of pedestal base on subfloor.

C. Adjust pedestals to permit top of installed panels to be set flat, level, and to proper height.

D. Stringer Systems: Secure stringers to pedestal heads according to access-flooring manufacturer's written instructions.

E. Install flooring panels securely in place, properly seated with panel edges flush. Do not force panels into place.

F. Scribe perimeter panels to provide a close fit with adjoining construction with no voids greater than 1/8 inch where panels abut vertical surfaces.

G. Clean dust, dirt, and construction debris caused by floor installation, and vacuum subfloor area as installation of floor panels proceeds.

H. Install access flooring without change in elevation between adjacent panels and within the following tolerances:
   1. Plus or minus 1/16 inch in any 10-foot distance.
   2. Plus or minus 1/8 inch from a level plane over entire access-flooring area.

3.4 PROTECTION

A. Prohibit traffic on access flooring for 24 hours and removal of floor panels for 72 hours after installation to allow pedestal adhesive to set.

B. Replace access-flooring panels that are stained, scratched, or otherwise damaged or that do not comply with specified requirements.

END OF SECTION 096900

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.

B. Related Sections include the following:
   1. Division 09 Section "Gypsum Board Assemblies" for surface preparation of gypsum board.
   2. Review all sections for shop primed items requiring field painting.

1.3 SUBMITTALS

A. General: Submit in accordance with Division 01 Section "Submittal Procedures."

B. Product Data: For each paint system indicated.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Engage an experienced Applicator who has completed painting system applications similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain primers for each coating system from the same manufacturer as the finish coats.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:
   1. Product name or title of material.
   2. Product description (generic classification or binder type).
   3. Manufacturer's stock number and date of manufacture.
   4. Contents by volume, for pigment and vehicle constituents.
   5. Thinning instructions.
   6. Application instructions.
   7. Color name and number.
   8. VOC content.

B. Store materials not in use in tightly covered containers in a well-ventilated area at a minimum ambient temperature of 45 deg F. Maintain containers used in storage in a clean condition, free of foreign materials and residue.
   1. Protect from freezing. Keep storage area neat and orderly.

2. Remove oily rags and waste daily.
3. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

B. 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. Sherwin-Williams Co. (S-W).

2.2 COATINGS MATERIALS, GENERAL

A. Material Compatibility: Provide 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.
1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers listed in the specification schedule. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

C. VOC Compliance 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. Non-Flat Paints and Coatings - High Gloss: VOC content of not more than 250 g/L.
4. Anticorrosive (Rust Preventative) Coatings: VOC content of not more than 400 g/L.
5. Industrial Maintenance Coatings (IMC): VOC content of not more than 340 g/L.
6. Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
7. Quick-Dry Primers, Sealers, and Undercoaters: VOC content of not more than 200 g/L.
8. Specialty Primers, Sealers, and Undercoaters: VOC content of not more than 350 g/L.

D. Colors: Provide color to match existing.

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.

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, dust, 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.

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. 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.
3. 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.

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.
3. Spray Equipment: Use airless spray equipment with orifice size 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) that are factory primed without permanent finish coating.

H. Prime Coats: Before applying finish coats, apply a prime coat, as recommended by manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces to ensure a finish coat with no burn-through or other defects due to insufficient sealing.

I. Pigmented (Opaque) Finishes: Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

J. 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.

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 LOW VOC INTERIOR COATINGS

A. VOC Compliance, General: Provide the manufacturers' formulations for the products specified below that comply with the VOC requirements for the State of Maine Department of Environmental Protection in paragraph 2.2.C of this Section.

B. Gypsum Board: Provide the following finish systems over interior gypsum board surfaces:
   1. Low-Luster - Eggshell (Field verify existing sheen and match existing), Acrylic-Enamel Finish, New and Existing GWBD Walls: 2 finish coats over a primer.
      a. Primer (New wallboard and patches only): 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: Eco Spec Interior Latex Primer Sealer No. 231; 1.0 mils DFT.
         2) ICI: LM9116, Prep & Prime Odor-Less Interior Water-Based Primer-Sealer; 1.9 mils DFT.
         3) S-W: Harmony Interior Latex Primer B11W900 Series; 1.3 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: SuperSpec Latex Eggshell Enamel W274; 2.6 mils DFT.
   2) ICI: 9300-XXXX Dulux Lifemaster Eggshell Interior Latex Enamel; 2.8 mils DFT.
   3) S-W: Harmony Interior Latex Eg-Shel B9 Series; 3.2 mils DFT.

C. Ferrous Metal, New: 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: IMC Acrylic Metal Primer M04; 2.0 mils DFT.
         2) ICI: IMC 4020-XXXX Devflex DTM Flat Interior/Exterior Waterborne Primer & Finish; 2.2 mils DFT.
         3) S-W: IMC Pro-Cryl Universal Water Based Primer, B66-310 Series; 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 4206-XXXX, Interior/Exterior Acrylic Semi-Gloss Enamel; 8.0 mils DFT.
         3) S-W: IMC Sher-Cryl HPA High Performance Semi-Gloss Acrylic, B66-350 Series; 7.5 mils DFT.

END OF SECTION 099000

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. Removal of two sprinkler heads and associated branch pipes for the two sprinklers.
   2. Pipes, fittings, and specialties.

1.3 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 destroys frangible device

1.4 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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
   1. NFPA 13, "Installation of Sprinkler Systems."

1.5 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.

1.6 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

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.

PART 3 - EXECUTION

3.1 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. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

E. Install sprinkler piping with drains for complete system drainage.

F. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

G. Fill sprinkler system piping with water.

3.2 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. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

3.3 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.

3.4 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.

END OF SECTION 211313

SECTION 212200 - CLEAN AGENT FIRE EXTINGUISHING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. The existing INERGEN system shall be shut off during the time that the Data Center space is under construction.

B. Modify the existing Inergen Clean Agent system in the Data Center. Remove the existing nozzles located in the ceiling and under the raised floor. Provide nozzles to protect the room and sub-floor spaces per the manufacturer's requirements. Extend the existing piping to all nozzles.

C. Remove the existing pull station and abort switch near the door slated for removal.

D. All equipment shall perform as a part of a single system. The system designed shall conform to all standards as described in the National Fire Protection Association Pamphlet 2001 - "Clean Agent Extinguishing Systems" - Latest Edition. These standards shall be used as a minimum design standard. Also considered are the requirements of the "Authority Having Jurisdiction", (Factory Mutual Engineering), and good engineering practices.

E. Materials and equipment shall be standard products of the manufacturer's design, and suitable to perform the functions intended. Where two or more pieces of equipment must perform the same functions, they shall be duplicates produced by one manufacturer. The name of the manufacturer, and the serial numbers, shall appear on all major components. Field fabricated equipment not supplied by the manufacturer will be unacceptable and will be grounds for system rejection, even after installation is completed unless all concerned parties are notified of the specific substitution prior to contractor's acceptance of order.

F. Quality Requirements: The contractors shall submit proof that the items furnished under this specification constitute a Underwriters Laboratory listed and Factory Mutual approved system. A complete schedule as indicated on the bidder and vendor data sheets shall be submitted within l0 (ten) days after receipt of notice to proceed and prior to starting installation. The schedule shall include catalog numbers, samples, drawings, of the devices to be installed and such other descriptive matter as may be required.

G. Standard Components: Equipment and accessories furnished by the contractor shall be the standard components of a specified manufacturer. Catalog numbers and model designations shall indicate design, quality and type of material as well as required operating characteristics.

H. Install the system to give full consideration to built-in spaces, piping, electrical equipment, ductwork, and all other construction and equipment.

1.2 QUALIFICATIONS OF INSTALLERS

A. The systems installation shall be supervised by a qualified factory certified technician regularly engaged by the firm responsible for the design of the INERGEN Fire Suppression, Detection, and Control System. The contractor shall be capable of conducting semi-annual system inspections of this system. . The contractor must be capable of reconditioning and recharging the entire system

within 24 hours.

B. VERIFICATION OF SPECIALIST: The bidder shall provide, along with the bid, the following information:
   1. Abbreviated history of the firm.
   2. Experience of the individuals who will perform the work.
   3. The installing contractor shall have the authorization from the system manufacturer to service, inspect and recharge the INERGEN system.
   4. The installing contractor shall provide certification of his capability to remove the INERGEN cylinders for recharge within 24 hours after notification of discharge. Certification shall include information as to the location and amount of contractor's bulk agent storage available.
   5. The installing contractor shall be an authorized stocking distributor of the manufacturer for the equipment included in the system so that immediate replacement parts can be made from inventory and, if needed, on an emergency basis. The contractor shall provide service personnel who shall be available for emergency service at all times 24 hours a day.
   6. The installing contractor shall provide proof of adequate insurance with initial proposal showing products liability coverage on the complete installation.

1.3 SUBMITTALS

A. Shop Drawings: Prepare and submit Shop Drawings in accordance with the requirements of Division 01, and obtain the Architect's approval and Owner's Insurance Underwriter's approval before proceeding with the fabrication and work.
   1. Shop Drawings and catalog cuts shall indicate Specification Section and paragraph requiring equipment submitted.
   2. Submit Data on the Following Items:
      a. Piping and couplings.
      b. Dispersion nozzles.
      c. Supports, hangers and accessories.
      d. Signage.
   3. Insurance Underwriter after Drawings are approved by the Architect.
   4. Submit to Owner's Insurance Underwriter sufficient copies for approval to allow one copy to be incorporated into each Owner's Manual in addition to the required As-Built Plans.

1.4 INSTRUCTION

A. Furnish instruction manuals containing complete operation and maintenance instructions for the specific make and model of the equipment furnished. Place one copy of each instruction manual in a flexible oil-resistant protective binder and mount in an accessible location in the vicinity of system control panel. Furnish three additional copies of each instruction manual.

B. Provide one 1-hour session of verbal instructions to the Owner.

PART 2 - PRODUCTS

2.1 SIGNS

A. During Construction, place a sign on the outside of the Data Center door. The sign shall be printed

as follows on an aluminum background with the word "WARNING" in 2" high letters:

1. INERGEN CLEAN AGENT SYSTEM IS INACTIVE DURING CONSTRUCTION

B. Install warning signs on the inside and outside the exit door from Inergen protected area. The sign shall be printed as follows on an aluminum background with the word "WARNING" in 2" high letters:

1. Exterior Door Sign:
   WARNING
   THIS SPACE IS PROTECTED BY AN INERGEN
   FIRE SUPRESSION SYSTEM.
   WHEN SYSTEM IS DISCHARGED AS A RESULT
   OF FIRE, CAUTION MUST BE TAKEN TO AVOID
   EXPOSURE TO PRODUCTS OF COMBUSTION.
   DO NOT ENTER WITHOUT APPROVED SELF-
   CONTAINED BREATHING APPARATUS OR
   UNTIL VENTILATIN HAS BEEN OPERATED
   FOR AT LEAST 15 MINUTES.
2. Interior Door Sign:
   WHEN ALARM SOUNDS
   VACATE AT ONCE
   INERGEN AGENT
   BEING RELEASED
3. Exterior sign near strobe: Sign shall be red background with white engraved letters.
   DO NOT ENTER
   WHEN THE LIGHT OPERATES
   THE INERGEN SYSTEM HAS DISCHARGED

2.2 SYSTEM DESIGN

A. This specification covers the requirement for an automatic fire detection and fixed fire extinguishing system(s) using INERGEN as the extinguishing agent.

B. Alarm signals and systems supervision shall be accomplished by a control panel with twenty-four (24) hour battery standby as listed by Underwriters' Laboratories and Factory Mutual.

C. Release of agent shall be accomplished by an electrical signal from the control panel. The sixty (60) second discharge time shall be in accordance with the requirements set forth in the National Fire Protection Association Standard 2001.

D. System Consideration and Requirements: In order to insure system effectiveness and owner satisfaction, the contractor shall supply and install all specified equipment and accessories for a complete, electrically supervised system as described and shown on the plans.

E. The appropriate quantity of Inergen will be directed to the individual hazard spaces with the utilization of Inergen selector valves. Only the U.L. listed method of selector valve operation will be considered.

F. The extinguishing systems shall provide release of INERGEN agent based on the concept of total flooding fire protection for enclosed, normally occupied areas. A uniform extinguishing concentration shall be created within the room and sub-floor volumes (where applicable) by the

release of a pre-determined amount of INERGEN. The amount of agent required is based upon the volume of the enclosure, the ambient temperature and the design concentration required.

G. The amount of INERGEN to be provided shall be the amount required to obtain a uniform (minimum) concentration as required by the design manual for ten (10) minutes. (Ansul INERGEN design, installation, recharge & maintenance manual part # 416655-09; U.L. file # EX 4510.) Take into consideration such factors as un-closable openings (if any), "rundown" time of fans, time required for dampers to close (and requirements for any additional dampers), and any other feature of the facility that could affect concentration. The design concentration shall be by volume at 70 F.

H. All system components and wiring shall be new and of current manufacture and shall be installed in accordance with current NFPA Standards and The National Electrical Code.

I. Ventilation and Leakage Effects: Design concentration shall be based upon maintaining the computer room equipment and the Heating, Ventilation and Air Conditioning (HVAC) systems during clean agent discharge. A soaking time of ten (l0) minutes shall be required; that is, the protected hazard space shall be properly sealed such that the specified agent concentration will be maintained in the hazard area for a minimum of ten (l0) minutes after completion of the initial agent discharge. The General Contractor shall coordinate all trades to insure the integrity of the hazard areas. It is the General Contractor responsible to ensure the sealing all opening, cable penetrations, holes, provides sweeps on doors along with mechanical door closers and weather stripping around doors. The Fire Suppression Contractor shall supply the calculation for the size of the Pressure Relief Vent/Damper and is not responsible for making the fan pressurization test pass due to unforeseen leakage present in the room. The pressure relief vent/damper must be supplied and installed under division 23.

2.3 SYSTEM COMPONENTS

A. Discharge Nozzles: The INERGEN discharge nozzles shall be designed to direct the discharge of the agent using stored pressure from the cylinders. The system design shall specify the quantity of nozzles and orifice sizes to be used for proper flow rate and distribution. The nozzles shall be constructed solid brass.

B. Control Equipment: Provide and install an integrated system of automatic devices. The devices, along with manual stations shall be used to activate a control panel. This panel shall process all inputs, sequence the levels of alarm and provide for outputs to the INERGEN agent storage cylinders. System shall have as standard equipment battery standby power so as to provide a minimum of 24 hours of battery power.

C. Smoke Detection System:
   1. Smoke detection shall be provided by the Very Early Smoke Detection Apparatus system (VESDA). The system shall activate on the actuation signal from the VESDA system.

2.4 MECHANICAL INSTALLATION

A. Piping of distribution system, down stream of the orifice union shall be black or galvanized steel pipe (ASTM A 53 or A l06) Schedule 40. Pipe fittings shall be Malleable Iron 300# Class (ASTM ll97) or ductile Iron 300# class (ASTM A 395) Ordinary cast iron pipe, steel pipe conforming to ASTM A 120, non-metallic pipe, or cast iron fittings shall not be used. Threaded pipe should be reamed and blown clear and swabbed with solvent to remove mill varnish and cutting oils before

assembly. Some effective solvents are trichlorethylene, percholorethylene, etc. Use Teflon tape only to seal threaded pipe joints. All piping must be rigidly supported by UL approved pipe hangers. Prior to nozzle installation, blow out the piping with compressed air to remove chips or other debris. The extinguishing system cylinders shall not be relied upon for support of piping. All piping shall be supported directly by the building structure.

B. These installation specifications are not meant to supersede the current edition of NFPA 2001. There shall be a support on the horizontal run within 6" or less of any vertical drop. Lateral bracing shall be provided at nozzles and where required to absorb forces developed during discharge. Design basis for pipe supports shall be actual weight plus 250# live load on each span. There shall be at least l/2" clearance around pipes fittings where they pierce floors or ceilings. A one-piece escutcheon shall be provided to dress the opening in addition to the appropriate fire rated sealing material, as required.

C. Conceal piping to the maximum extent possible. Piping shall be inspected, tested, and approved before being concealed. Provide fittings for changes in direction of piping and for all connections. Make changes in piping sizes through standard reducing pipe fittings; the use of bushings is not permitted.

D. Pipe hangers and supports shall be adjustable type. Pipe shall be installed to allow for thrust. Finish of rods, hangers, and supports shall be zinc-plated. Provide pipe hangers and supports as follows:

1.

Nominal Pipe Size (inches)	Maximum Spacing (feet)
1-1/4" and under	8
1-1/2" and over	12

2. A hanger should be installed between fittings when the fittings are more than two feet apart.
3. A hanger should be installed at a maximum of one foot from nozzles.
4. The hangers shall be U.L. listed and rigidly supported. No clevis hangers are allowed.

E. Escutcheon plates shall be provided for piping passing through floors, walls, and ceilings with approved type, one piece or split type plates. Plates where pipe passes through finished ceilings shall be chromium-plated. Other plates shall be of steel or cast iron, with aluminum paint finish. Securely anchor plates in place with set screws or other approved positive means.

F. Installing contractor shall pressure test pipe in accordance with NFPA 2001, in a closed circuit for 10 minutes at 40 psi and supply written documentation of the results.

2.5 SYSTEM CONTROL

A. Control Panel Description: The existing control panel shall be utilized to support all of the specifications indicated below.

B. The control unit board shall contain the microprocessor based logic, database, memory, field wiring, terminal blocks, auxiliary relays and switches.

1. Display Board shall contain the LED/LCD indicators.
2. Standby batteries (24 hour minimum)
3. The front of the control panel shall incorporate an alpha-numeric display to show the functional status of the system
4. Regulated Power Supply (2 ampere standard).

5. The 2 ampere internal power supply operates from 120 VAC at 50/60 Hertz input voltage. The maximum AC input current is 1 ampere fused at 1.5 ampere. Losing primary power automatically transfers the unit to a secondary power source (rechargeable gell-cell batteries). The "Power On" LED extinguishes and a trouble condition annunciates with AC power loss. After 24-hours, the batteries still accommodate a full alarm condition for 5 minutes (see battery requirement calculation). The float charged batteries provide fast recover after primary power restores. Battery placement and condition is supervised.
6. Each input circuit shall provide and/or monitor the condition of initiating devices and shall be continually supervised. Inputs shall be used to monitor the following as a minimum.
    a. VESDA system signaling.
    b. Manual pull stations.
    c. Abort Stations
    d. Dedicated manual actuation circuits.

C. Output circuits shall be polarity reversing, 24 VDC circuits supervised for open and short circuits.
1. Audible alarm output circuits shall provide distinctively different sounds for each stage of the releasing sequence either by different type signaling devices of by "coding" the same type signaling devices as follows:
    a. General alarm, first alarm: ALARM BELL
    b. Pre-discharge alarm: HORN/STROBE
    c. System fired: EXTERIOR MOUNTED STROBE
    d. The panel shall be capable of sending alarm and trouble signals through two sets of contacts.

D. Releasing output circuits shall be used with compatible releasing device for fire suppression system discharge. A programmable time delay of 30 seconds shall be provided between verification of fire situation and suppression system release.

E. Auxiliary Relays
1. Five auxiliary relays shall be available as an integral component to the processor control board.
2. The relays shall be from C-DPDT relay contacts rated at 10 amperes at 30 VDC and 110 VAC, 7.5 amperes at 220 VAC.
3. The software-controlled relays shall operate with the function of input/output circuits as follows.
    a. First detector in alarm shall energize: General Alarm Relay
    b. Second detector in alarm shall energize: Pre-discharge relay.
    c. Timer times out, no abort action, release circuit activated shall energize system fired relay.

F. System trouble condition shall de-energize: Trouble Relay
1. One extra relay shall be available to be field programmable to duplicate the function of the general alarm relay or the pre-discharge relay.

G. System reset: Momentarily interrupts power to the electronics, which "unlatches" circuit in alarm. If a sensor is still in alarm mode, the control unit will alarm again.
1. Trouble silence: Silences the internal trouble buzzer. A subsequent trouble condition shall cause the trouble buzzer to re-activate. When all trouble conditions are corrected, the trouble LED is extinguished and the control unit is reset automatically.
2. Alarm silence: Silences all affected audible alarm circuits. Audible alarm will re-ring upon

receiving a subsequent alarm.

3. Diagnostic test: Source of various trouble conditions shall be determined by usual LED's or an audible coded system in order to restore control unit to normal condition and minimize down time. This self-diagnostic ability shall isolate trouble to board, module level.
4. Lamp test: To test integrity of all LED's and internal trouble buzzer.

H. Control unit shall be housed in a metal enclosure of 16-gauge steel. All wiring connections shall be made to screw terminal blocks. The control unit shall be furnished in a beige finish.

2.6 MANUAL RELEASE STATION AND ABORT STATION

A. Labeled manual release stations shall be supplied near the room exits.
1. Manual release shall be of the dual action type.

B. An abort station shall be mounted adjacent to each manual release station.

C. The abort button may be pushed and held to prevent agent discharge. Provide all apparatus, accessories, components, and associated materials specified or necessary to furnish system complete and ready for operation.

2.7 ELECTRICAL INSTALLATION

A. Wiring for the control system, the INERGEN extinguishing system and damper trip or releases shall be run in accordance with the NFPA standards, and manufacturers specifications. Wiring must be in conduit. Use l6 AWG minimum 600 volt, l05 C. UL listed wire. Make wire runs continuous, unless unusually long runs make splices unavoidable. Splices must be soldered; wire nuts are not acceptable. NOTE: The ll5 volt 60 Hz. single phase power input circuit must be in separate conduit and connected to the main building power through a separate l5 amp circuit, dedicated to the extinguishing system.

B. Electrical equipment and wiring shall be in accordance with Division 26, Electrical.

2.8 SYSTEM OPERATION

A. Should the VESDA system signal an Alarm Level 1 (Alert) condition, the following shall occur:
1.
2. A local alarm bell shall sound.
3. An alert signal shall be sent to the building fire alarm system (wiring by electrical subcontractor).
4. The control panel zone alarm lamp, red, shall light.
5. The VESDA Level 1 Alert will be displayed on the LCD display.

B. Should the VESDA system signal an Alarm Level 2 (Action) condition, the following shall occur:
1. A local horn/strobe shall sound indicating the start of a 20 second pre-discharge time delay.

C. Should the VESDA system sense an Alarm Level 3 (Fire 1) condition, the following shall occur:
1. Fire alarm panel goes into full alarm condition.

D. Should the VESDA system sense an Alarm Level 4 (Fire 2) condition the following shall occur:

1. Release of the INERGEN System.
2. The horn/strobe shall continue to operate.
3. Strobe lights, located outside each entrance to the protected space, shall operate.

2.9 OPERATING INSTRUCTIONS

A. Provide operating instructions at control panel and remote actuating station. Instructions shall clearly indicate all necessary steps for the operation of the system. Submit the proposed legend for operating instructions for approval prior to installation. Instructions shall be in raised or embossed white letters on red rigid plastic or enameled steel backgrounds and shall be of adequate size to permit them to be easily read.

2.10 IDENTIFICATION

A. Conductors: All circuit conductors shall be identified within each enclosure where a tap, splice, or termination is made. Conductor identification shall be by plastic-coated, self-sticking printer markers or by heat-shrink type sleeves. Properly identify control circuit terminations.

B. Tags: On all valves, install brass or aluminum identification tags indicating function of the valve, size and working pressure.

C. Identify all piping in accordance with labels, tapes, painting, or stenciling.

2.11 SPARE PARTS

A. One spare set of fuses of each type and size required, and 2% of the total number of smoke sensors, but not less than two thereof, shall be furnished.

PART 3 - EXECUTION

3.1 SYSTEM CHECKOUT, OWNER TRAINING AND ACCEPTANCE:

A. Upon completion of the installation and functional testing, a meeting shall be held at the site with contractor, and owners personnel present. The contractor shall familiarize the owner’s personnel with system components, system functions and recommended procedures. At this time, a functional test of the system will be performed, for the purpose of educating the owner’s personnel. The contractor shall provide the necessary personnel and instruments to conduct this test. The contractor will provide the owner with a system checklist, which the owner will sign as acceptance of the system. The contractor will provide the owner with a complete operational and maintenance manual as well as a written summary of any functional tests conducted.

3.2 WARRANTY:

A. All system components furnished under this contract shall be guaranteed against defective design, materials and workmanship for the full warranty time which is standard with the manufacturer and/or supplier, but in no case less than one (1) year from the date of system acceptance. The Control and Detection equipment shall be warranted for a period of one (1) year with labor included during the first year. Upon receipt of notice from the customer of failure of any component during the warranty period, the system shall be repaired promptly with new parts at the expense of and by the Contractor.

B. False Discharge Warranty: The manufacturer of the extinguishing /detection system shall replace the INERGEN gas and pay reasonable costs to recharge the INERGEN /Detection and Control System where in the manufacturers opinion, the unwanted discharge has occurred due to a defect in the material or workmanship of the products provided by this manufacturer. This warranty shall be in affect for the period of ten (20) years commencing with the acceptance of the system by the owner.

END OF SECTION 212200

SECTION 212250 – VERY EARLY SMOKE DETECTION APPARATUS

PART 1 - GENERAL

1.1 DESCRIPTION

A. The Very Early Smoke Detection Apparatus shall be monitor the occupied data center space and also the raised floor below.

B. The system consists of highly sensitive laser based smoke detector using aspirated air sampling and is connected to sampling pipes. It shall be provided with a single sample pipe inlet, internal flow monitoring, smoke detection and a facility for exhaust pipe connection. Reset, disable, test and fault determination functions will be available via the field service access door. System configuration will be provided through AutoLearn Smoke and Flow functions, also available via the field service access door.

C. The system shall support Pre-Engineered sampling pipe network designs with verified calculations in addition to custom sampling pipe network designs using a computer based design modeling tool. Sampling pipe material shall be UL 1887 approved for use in air sampling smoke detection systems.

1.2 APPROVALS

A. The Very Early Smoke Detection System (VESDA) must be of a type submitted to, tested, approved, and/or listed by a Nationally Recognized Testing Laboratory (NRTL) as follows:
   1. UL (Underwriters Laboratories Inc), USA
   2. ULC (Underwriters Laboratories Canada), Canada
   3. FM (Factory Mutual), and FM approved for Hazardous Locations, Class 1, Div.2, Groups A,B,C,D (3020906), USA
   4. Local Codes and Standards
   5. Year 2000 Accreditation.

1.3 CODES, STANDARDS OR REGULATIONS

A. The VESDA smoke detector shall be installed to comply with one or more of the following codes or standards:
   1. NFPA Standards
   2. NEC Standard
   3. Local codes and standards
   4. Year 2000 compliancy standards including, LPS2000, GTE PA96014T.

1.4 SYSTEM DESCRIPTION

A. Design Requirements
   1. The detector shall consist of a highly sensitive laser based smoke detector, an aspirator, and a dual-stage filter cartridge.
   2. It shall be modular, with each detector optionally monitored by a Display featuring LEDs and a sounder. The system shall be configured by a Programmer that is either integral to the system, portable or PC based.

3. The system shall allow programming of:
    a. Four smoke threshold alarm levels;
    b. Time delays;
    c. Faults including airflow, detector, power, filter and network as well as an indication of the urgency of the fault;
    d. Seven or more configurable relay outputs for remote indication of alarm and fault conditions.
4. The system shall It shall consist of an air sampling pipe network to transport air to the detection system, supported by calculations from a computer-based design modeling tool.
5. Optional equipment shall include intelligent remote displays and/or a high level interface with the building fire alarm system, or a dedicated VESDA System Management (VSM) graphics package.
6. Performance Requirements
    a. Tested and approved to cover up to 20,000 sq. ft.
    b. Approved to provide very early smoke detection and provide four output levels corresponding to Alert, Action, Fire 1 and Fire 2. These levels shall be programmable and able to be set at sensitivities ranging from 0.005 – 0.0015–6% obsc/ft. For compliance to UL approval range is 0.0015-4% obsc/ft.
    c. Report any fault on the unit by using configurable fault output relays or via VSM.
    d. Self monitoring for filter contamination.
    e. Incorporate a flow sensor in each pipe and provide staged airflow faults.

1.5 SUBMITTALS

A. Product data and site drawings shall be submitted and shall include pipe layout, operational calculations (ASPIRE) and performance criteria.

B. A copy of the manufacturer’s product manual shall be supplied to customer upon completion of the installation.

C. System commissioning data shall be supplied (in a format recommended by the manufacturer and per the instructions provided by the manufacturer) within 30 days of completion of the installation.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications
1. The manufacturer shall have a minimum of 15 years production experience in the manufacture and design of high sensitivity air sampling smoke detection systems.
2. The manufacturer shall be certified as meeting ISO 9001:2000 for manufacturing.

B. Technology
1. Both light scattering and particle counting shall be utilized in this device as follows:
2. The laser detection chamber shall be of the mass light scattering type and capable of detecting a wide range of smoke particle types of varying size. A particle counting method shall be employed for the purposes of:
    a. Preventing large particles from affecting the true smoke reading.
    b. Monitoring contamination of the filter (dust & dirt etc.) to automatically notify when maintenance is required.

c. The particle counting circuitry shall not be used for the purpose of smoke density measurement.

3. The laser detection chamber shall incorporate a separate secondary clean air feed from the filter to provide clean air barriers across critical detector optics to eliminate internal detector contamination.

4. The detector shall not use adaptive algorithms to adjust the sensitivity from that set during commissioning. A learning tool shall be provided to ensure the best selection of appropriate alarm thresholds during the commissioning process.

C. Equipment Supplier

1. The equipment supplier shall be authorized and trained by the manufacturer to calculate, design, install, test and maintain the air sampling system and shall be able to produce a certificate stating such on request.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Air Sampling Smoke Detection System: Acceptable Manufacturer:

Xtralis
700 Longwater Drive
Norwell, MA 02061
Telephone: (781) 740-2223
Fax: (781) 740-4433
Website: www.xtralis.com

2.2 MANUFACTURED UNITS

A. The VESDA LaserPLUS air sampling smoke detection system is available in the following configurations:

Part Number	Description
VLP-000	LaserPLUS Detector
VLP-002	Detector with integral display.
VLP-012	Detector with integral display and programmer.
VLP-400	Detector only with Fault/OK lights.

2.3 DETECTOR ASSEMBLY

A. The detector, filter, aspirator and relay outputs shall be housed in a mounting box and shall be arranged in such a way that air is drawn from the fire risk area and a sample of air is passed through the dual stage filter and detector by the aspirator.

B. The detector shall be laser-based type and shall have an obscuration sensitivity range of 0.0015 – 6% obs/ft.

C. The detector shall have four independent field programmable smoke alarm thresholds across its sensitivity range with adjustable time delays for each threshold between 0 - 60 seconds.

D. The detector shall also incorporate the facility to transmit the following faults:
   1. Detector.
   2. Air Flow.
   3. Filter.
   4. System.
   5. Zone.
   6. Network.
   7. Power.
   8. Urgent and minor faults. Minor faults shall be considered as servicing or maintenance signals. Urgent faults indicate the unit may not be able to detect smoke.

E. The detector shall have four in-line sample pipe inlets and must contain a flow sensor for each pipe. Both minor and urgent flow faults may be reported.

F. The filter must be a two-stage disposable filter cartridge. The first stage shall be capable of filtering particles in excess of 20 microns from the air sample. The second stage shall be ultra- fine, removing more than 99% of contaminant particles of 0.3 microns or larger, to provide a clean air barrier around the detector's optics to prevent contamination and increase service life.

G. The aspirator shall be a purpose-designed rotary vane air pump. It shall be capable of allowing for multiple sampling pipe runs up to 600 ft. in total, (4 pipe runs per detector) with a transport time of less than 120 seconds or as appropriate codes dictate.

H. The assembly must contain relays for basic alarm and fault conditions. The relays shall be software programmable to the required functions. The relays must be rated at 2 A at 30 VDC. Remote relays shall be offered as an option and either configured to replicate those on the detector or programmed differently.

I. The assembly shall be able to be surface mounted to a wall or recessed in the wall cavity.

J. The assembly shall have built-in event and smoke logging. It shall store smoke levels, alarm conditions, operator actions and faults. The date and time of each event shall be recorded. Each detector (zone) shall be capable of storing up to 18,000 events and does not require the presence of a display to do so.

2.4 DISPLAYS

A. Each Display shall provide the following features at a minimum:
   1. A 20 segment bar graph display.
   2. Four independent high intensity alarm indicators, Alert, Action, Fire 1 and Fire2, corresponding to the four alarm thresholds of the detector.
   3. Alarm threshold indicators for Alert, Action and Fire 1.
   4. Detector fault and airflow fault indicators.
   5. Faults originating in the particular VLP zone (Zone Fault) shall be distinguished from those produced by the overall smoke detection system and from those resulting from network wiring errors (Network Fault). LED indicators shall be provided for each fault category.
   6. Minor and urgent fault LED indicators.
   7. A remotely mounted Display may be optionally equipped with 7 or 12 configurable relays for signaling alarm and fault conditions.
   8. Four buttons supporting the following features:

a. Mode/Test - Scrolls through the information on the Display's digital display:
b. Sensitivity (Fire 1 Threshold setting), current smoke level and VLP Zone number.
c. When pressed and held initiates a lamp test on the individual display module.
d. Silence -Silences all devices on the system
e. Reset -Unlatches all latched alarm conditions on the assigned VLP zone.
f. Isolate - Isolates the individual VLP zone (inhibits Alarm and Fault relays and initiates Isolate relay).

2.5 PROGRAMMERS

1. When required, a Programmer module may be located within the detector, a remote mounting box, a 19 inch remote rack, or in a portable hand-held unit. Alternatively, programming may be performed using a Windows® application running on a PC connected through a High Level Interfacing unit (PC-Link HLI).
2. Each Programmer shall support the following features at a minimum:
   a. Programming of any device on the VESDAnet system.
   b. Viewing of the status of any device in the system.
   c. Adjustment of the alarm thresholds of a nominated detector.
   d. Setting of Day/night, weekend and holiday sensitivity threshold settings.
   e. Initiation of AutoLearn™, to automatically configure the detector's alarm threshold settings to suit the current environment.
   f. Multi-level password control.
   g. Programmable latching or non-latching relay operation.
   h. Programmable energized or de-energized relays.
   i. Programmable high and low flow settings for airflow supervision.
   j. Programmable aspirator speed control.
   k. Programmable maintenance intervals.
   l. Facilities for referencing with time dilution compensation.
   m. Testing of relays assigned to a specific zone to aid commissioning.

2.6 DEVICE NETWORKING REQUIREMENTS

A. The devices in the smoke detection system shall be capable of communicating with each other via twisted pair RS485 cable. The network shall be able to support up to 250 devices (detectors, displays and programmers), of which at least 100 detectors can be supported.

B. The network shall be capable of being configured in a fault tolerant loop for both short circuit and open circuit. Any communication faults shall be reported unambiguously and shall be clearly attributable to an individual device or wire link in the fault messages.

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C. PC based configuration tools shall be available to configure and manage the network of detectors.

2.8 DIGITAL COMMUNICATION PORT

A. Shall comply with EIA RS485 Protocol.

2.9 APPLICATION

A. Detection Alarm Levels
1. The laser based Air Sampling detection system shall have four (4) independently programmable alarm thresholds. The four alarm levels may be used as follows:
   a. Alarm Level 1 (Alert) Activate a visual and audible alarm in the fire risk area
   b. Alarm Level 2 (Action) Activate visual and audible alarms in the Security Office or other appropriate location.
   c. Alarm Level 3 (Fire 1) initiates an alarm condition in the Fire Alarm Control Panel to call the Fire Brigade and activate all warning systems.
   d. Alarm Level 4 (Fire 2) Activate a suppression system and/or other suitable counter measures.

B. Initial Detection Alarm Settings
1. Initial settings for the alarm levels shall be determined by the requirements of the fire zone. However, the setting for Fire 1 (Alarm Level 3) shall always appear as 100% on the bar graph scale. Default settings of the unit shall be:

Alarm Level 1 (Alert)	0.025% obs/ft
Alarm Level 2 (Action)	0.044% obs/ft
Alarm Level 3 (Fire 1)	0.062% obs/ft
Alarm Level 4 (Fire 2)	0.61% obs/ft

C. Initial (factory default) Alarm Delay Thresholds
1. Initial (factory default) settings for the alarm delay threshold shall be:

Alarm Level 1 (Alert)	10 seconds
Alarm Level 2 (Action)	10 seconds
Alarm Level 3 (Fire 1)	10 seconds
Alarm Level 4 (Fire 2)	10 seconds
Fault Alarm	5 seconds

D. Fault Alarms
1. The detector fault relay shall be connected to the appropriate alarm zone on the Fire Alarm Control Panel in such a way that a detector fault would register a fault condition on the FACP. The fault relay shall also be connected to the appropriate control system.
2. Check local Codes, Standards or Regulations to determine whether compliance with this set-up is required.

E. Power Supply and Batteries
1. The system shall be powered from a regulated supply of nominally 24V DC. The battery charger and battery shall comply with the relevant Codes, Standards or Regulations. Typically 24 hours standby battery back up is required followed by 30 minutes in an alarm condition. Local Power Supply Standards that may apply:

   a. UL 1481 Listed (provided the power supply and standby batteries have been appropriately sized/rated to accommodate the system's power requirements).
   b. US Telecommunication Central Office Power Supply: The system shall operate on

negative 48 VDC (provided continuously from the telephone central office power source) converted to 24VDC.

2.10 SAMPLING PIPE DESIGN

A. Sampling Pipe
1. The sampling pipe shall be smooth bore with an internal diameter between ¾ to 1 inch. Normally, pipe with an outside diameter of 1 inch and internal diameter of ¾" should be used.
2. The pipe material should be suitable for the environment in which it is installed, or should be the material as required by the specifying body.
3. All joints in the sampling pipe must be air tight and made by using solvent cement, except at entry to the detector.
4. The pipe shall be identified as Air Sampling Smoke Detector Pipe (or similar wording) along its entire length at regular intervals not exceeding the manufacturers' recommendation or that of local codes and standards.
5. All pipes should be supported at not less than 5ft centers, or that of the local codes or standards.
6. The far end of each trunk or branch pipe shall be fitted with an end cap and drilled with a hole appropriately sized to achieve the performance as specified and as calculated by the system design.

B. Sampling Holes
1. Sampling holes of 5/64", or otherwise appropriately sized holes (see Section 3.05), shall not be separated by more than the maximum distance allowable for conventional point detectors as specified in the local code or standard. Intervals may vary according to calculations.
2. Each sampling point shall be identified in accordance with Codes or Standards.
3. Consideration shall be given to the manufacturers' recommendations and standards in relation to the number of Sampling Points and the distance of the Sampling Points from the ceiling or roof structure and forced ventilation systems.

PART 3 - INSTALLATION

3.1 THE DETECTION SYSTEM

A. The contractor shall install the system in accordance with the manufacturer's System Design Manual.

3.2 THE CAPILLARY SAMPLING NETWORK

A. Where ceilings are installed, the sampling pipe shall be installed above the ceiling, and capillary-sampling points shall be installed on the ceiling and connected by means of a capillary tube.

B. The minimum internal diameter of the capillary tube shall be 3/8", the maximum length of the capillary tube shall be 7 ft unless the manufacturer in consultation with the engineer have specified otherwise.

C. The capillary tube shall terminate at a ceiling sampling point specifically designed and approved by the manufacturer. The performance characteristics of the sampling points shall be taken into account during the system design.

3.3 AIR SAMPLING PIPE NETWORK CALCULATIONS

A. Air Sampling Pipe Network Calculations shall be provided by a sampling pipe Air Sampling modeling program such as ASPIRE (latest Version; ASPIRE for Windows TM Version
   1. Pipe work calculations shall be supplied with the proposed pipe layout design to indicate the following performance criteria:
      a. Transport Time
      b. The manufacturers recommended transport time (time taken for the smoke to enter the pipe and reach the detector) for the least favorable sampling point is 60 seconds or less.
      c. NFPA 72 US 120 Seconds.
      d. Balance %
      e. The sample point balance for the pipe shall not be less than 70% as indicated by ASPIRE. That is, the volume of air drawn from the last sampling point shall not be less than 70% of the average volume of air through the other holes.
      f. Share %
      g. The sample hole share for the pipe shall not be less that 70% as indicated by ASPIRE. That is, the sum volume of air drawn through the sampling holes must always be greater than 70% of the total volume of air entering the pipe (i.e. the End Vent must not exceed 30% of the total flow).

3.4 COMMISSIONING TESTS

A. The contractor shall allow for the manufacturer's representative to attend commissioning of the entire installation in the presence of the owner and/or its representative.

B. The Contractor shall provide all necessary instrumentation, equipment, materials and labor.

C. The Contractor shall record all tests and system calibrations and a copy of these results shall be included in the project documents.

3.5 SYSTEM CHECKS

A. Visually check all pipes to ensure that all joints, fittings, bends, sampling points, etc., comply with these specification.

B. Check the system to ensure the following features are operational and programmed in accordance with the specification.
   1. Alarm threshold levels (for both day and night settings)
   2. Pipes in use
   3. Detector address
   4. Display address
   5. Clock and Date
   6. Time Delays
   7. Air flow fault thresholds
   8. Display buttons operable (Mode, Silence, Reset, Isolate)

9. Referencing
10. Units set to U.S./S.I

C. Check to ensure that all ancillary warning devices operate as specified.

D. Check interconnection with Fire Alarm Control Panel to ensure correct operation.

3.6 TESTS

A. Introduce Smoke into the Detector Assembly to provide a basic functional test.

B. Introduce smoke to the least favorable Sampling Point in each Sampling Pipe. Transport time is not to exceed the local codes (see 3.03).

C. If more than two bar graph divisions illuminate under normal conditions (no smoke test), review event log for two (2) weeks from date of commissioning and make appropriate adjustments to the alarm and delay thresholds.

D. Activate the appropriate Fire Alarm zones and advise all concerned that the system is fully operational. Fill out the log book and commissioning report accordingly.

END OF SECTION 212250

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. Epco Sales, Inc.
   e. Hart Industries, International, Inc.
   f. Watts Industries, Inc.; Water Products Div.
   g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.
1. Manufacturers:
   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco 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 Section "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.

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 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.
      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. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Ball Valves: Two piece, full port, bronze with bronze trim.
   3. Bronze Swing Check Valves: Class 150, bronze disc.

END OF SECTION 220523

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 Piping 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.
   b. Armacell LLC; AP Armaflex.
   c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.

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; 1000(Pipe Insulation.
   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. All 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. 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 ½ and NPS ¾ : 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 and Recirculated Hot Water:
1. NPS 1 (DN 25) and Smaller: Insulation shall be one of 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.

C. Stormwater and Overflow:
1. All Pipe Sizes: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: [1 inch (25 mm)] <Insert thickness> thick.

D. Roof Drain and Overflow Drain Bodies:
1. All Pipe Sizes: Insulation shall be[one of] the following:
a. Flexible Elastomeric: 1 inch (25 mm) thick.
b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch (25 mm) thick.

E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
1. All Pipe Sizes: Insulation shall be the following:
a. Pre-molded closed cell urethane, white color.

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.

B. LEED Submittal:
1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

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.

D. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 (DN 50. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for balancing valves.

E. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Comply with requirements in Division 22 Section "Domestic Water Piping Specialties" for calibrated balancing valves.

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, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
   a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide flow of hot water in each branch.
   b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.10 CLEANING

A. Clean and disinfect potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
b. Fill and isolate system according to either of the following:
   1) Fill system or part thereof with water/chlorine solution with at least 50 ppm (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. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
3. 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. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated water mixing valves.
6. Strainers.
7. Outlet boxes.
8. Hose stations.
9. Hose bibbs.
10. Wall hydrants.
11. Ground hydrants.
12. Post hydrants.
13. Drain valves.
14. Water hammer arresters.
15. Air vents.
16. Trap-seal primer valves.
17. Trap-seal primer systems.

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.
2. Division 22 Section "Domestic Water Piping" for water meters.
3. Division 22 Section "Emergency Plumbing Fixtures" for water tempering equipment.
4. Division 22 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.

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 VACUUM BREAKERS

A. Pipe-Applied, Atmospheric-Type Vacuum Breakers:
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. Ames Co.
   b. FEBCO; SPX Valves & Controls.
   c. Watts Industries, Inc.; Water Products Div.
   d. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1001.
4. Size: NPS 1/4 to NPS 3 (DN 8 to DN 80), as required to match connected piping.
5. Body: Bronze.
6. Inlet and Outlet Connections: Threaded.
7. Finish: Rough bronze.

2.2 BACKFLOW PREVENTERS

A. Intermediate Atmospheric-Vent 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:
   a. FEBCO; SPX Valves & Controls.
   b. Watts Industries, Inc.; Water Products Div.
   c. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1012.
4. Operation: Continuous-pressure applications.
5. Size: [**NPS 1/2 (DN 15)**] [**NPS 3/4 (DN 20)**].
6. Body: Bronze.

7. End Connections: Solder joint.
8. Finish: Rough bronze.

B. 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: 2” **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.

2.3 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:
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. Watts Industries, Inc.; Water Products Div.
   b. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1003.
4. Pressure Rating: Initial working pressure of 150 psig (1035 kPa).
5. Size: 1/2”.
6. Design Flow Rate: 5 gpm (L/s).
7. Design Inlet Pressure: 60 psig (kPa).
8. Design Outlet Pressure Setting: 20 psig (kPa).
9. Body: Bronze for NPS 2 (DN 50) and.
10. Valves for Booster Heater Water Supply: Include integral bypass.
11. End Connections: Threaded for NPS 2 (DN 50) and smaller.

2.4 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
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. Armstrong International, Inc.
   b. ITT Industries; Bell & Gossett Div.
   c. NIBCO INC.
   d. Taco, Inc.
   e. Watts Industries, Inc.; Water Products Div.
4. Type: Ball valve with two readout ports and memory setting indicator.
5. Body: bronze,
6. Size: Same as connected piping, but not larger than NPS 2 (DN 50).
7. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

B. Hi-Low, Thermostatic, Water-Mixing-Valve Assemblies :
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 Powers, or a comparable product by one of the following:
   a. Leonard Valve Company.
   b. Powers; a Watts Industries Co.
   c. Symmons Industries, Inc.
4. Description: Factory-fabricated, exposed-mounting, thermostatically controlled, water-mixing-valve assembly in **two**-valve parallel arrangement.
5. Large-Flow Parallel: Thermostatic water mixing valve and downstream pressure regulator with pressure gages on inlet and outlet.
6. Small-Flow Parallel: Thermostatic water mixing valve.
7. Thermostatic Mixing Valves: Comply with ASSE 1017. Include check stops on hot- and cold-water inlets and shutoff valve on outlet.
8. Water Regulator(s): Comply with ASSE 1003. Include pressure gage on inlet and outlet.
9. Component Pressure Ratings: 125 psig (860 kPa) minimum, unless otherwise indicated.
10. Selected Large Flow, Tempered Water Valve Size: 1-1/2”.
11. Tempered-Water Setting: 122 **deg F (deg C).**
12. Unit Tempered-Water Design Flow Rate: 404.3 gpm (L/s).
13. Unit Minimum Tempered-Water Design Flow Rate: 0.5gpm (L/s).
14. Unit Pressure Drop at Design Flow Rate: 10 psig (kPa).
15. Unit Tempered-Water Outlet Size: 1-1/4” NPS (DN)> end connection.
16. Unit Hot- and Cold-Water Inlet Size: 1-1/4” NPS (DN)> end connections.
17. Thermostatic Mixing Valve and Water Regulator Finish: Rough bronze.
18. Piping Finish: Copper.

C. Individual-Fixture, Water Tempering Valves for each sink and lavatory. (Exception; L-2 & L3 supplied with manufacturers mixing valve):

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. Lawler Manufacturing Company, Inc.
    b. Leonard Valve Company.
    c. Powers; a Watts Industries Co.
    d. Watts Industries, Inc.; Water Products Div.
    e. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1016, thermostatically controlled water tempering valve.
4. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
5. Body: Bronze body with corrosion-resistant interior components.
6. Temperature Control: Adjustable.
7. Inlets and Outlet: Threaded.
8. Finish: Rough bronze.
9. Tempered-Water Setting: 110 deg F (deg C).
10. Provide mixing valves for each kitchen hand sink, all sinks and lavatories in the building.

2.5 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:
1. Pressure Rating: 125 psig (860 kPa) minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 (DN 50) and smaller; cast iron with interior lining complying with AWWA C550 for NPS 2-1/2 (DN 65) and larger.
3. End Connections: Threaded for NPS 2 (DN 50) and smaller; flanged for NPS 2-1/2 (DN 65) and larger.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Perforation Size:
    a. Strainers NPS 2 (DN 50) and Smaller: 0.020 inch (0.51 mm) .
    b. Strainers NPS 2-1/2 to NPS 4 (DN 65 to DN 100): 0.045 inch (1.14 mm) .
6. Drain: Factory-installed, hose-end drain valve.

2.6 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.

B. Icemaker 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. Acorn Engineering Company.
   b. Oatey.
3. Mounting: Recessed.
4. Material and Finish: **Plastic** box and faceplate.
5. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 (DN 15) or smaller copper tube outlet.
6. Supply Shutoff Fitting: NPS 1/2 (DN 15) gate, globe, or ball valve and NPS 1/2 (DN 15) copper, water tubing.

2.7 HOSE BIBBS

A. Hose Bibbs:
1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig (860 kPa).
7. Vacuum Breaker: Integral nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Chrome plated.
9. Finish for Service Areas: Chrome plated.
10. Finish for Finished Rooms: Chrome plated.
11. Operation for Equipment Rooms: Operating key.
12. Operation for Service Areas: Operating key.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include wall flange with each chrome-plated hose bibb.

2.8 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:
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. Josam Company.
   b. MIFAB, Inc.
   c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
   d. Tyler Pipe; Wade Div.
   e. Watts Drainage Products Inc.
   f. Woodford Manufacturing Company.
   g. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.21.3M for concealed -outlet, self-draining wall hydrants.
4. Pressure Rating: 125 psig (860 kPa).
5. Operation: Loose key.
6. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
7. Inlet: NPS 3/4.
8. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
9. Box: Deep, flush mounting with cover.
10. Box and Cover Finish: Polished nickel bronze .
11. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
12. Nozzle and Wall-Plate Finish: Polished nickel bronze .
13. Operating Keys(s): One with each wall hydrant.

2.9 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.

2.10 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.

2.11 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
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 Industries, Inc.; Water Products Div.
3. Standard: ASSE 1018.
4. Pressure Rating: 125 psig (860 kPa) minimum.
5. Body: Bronze.
6. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint.
7. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint.
8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

B. Drainage-Type, Trap-Seal Primer Valves (See faucets and flushometers in Section 214000 “Plumbing Fixtures”:
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. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
3. Zurn.Standard: ASSE 1044, lavatory P-trap with NPS 3/8 (DN 10) minimum, trap makeup connection.
4. Size: NPS 1-1/4 (DN 32) minimum.
5. Material: Chrome-plated, cast brass.

2.12 TRAP-SEAL PRIMER SYSTEMS

A. Trap-Seal Primer Systems:
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. PPP Inc.
4. Standard: ASSE 1044,
5. Piping: NPS 3/4, ASTM B 88, Type L (DN 20, ASTM B 88M, Type B); copper, water tubing.
6. Cabinet: Surface-mounting steel box with stainless-steel cover.
7. Electric Controls: 24-hour timer, solenoid valve, and manual switch for 120-V ac power.
8. Vacuum Breaker: ASSE 1001.
9. Number Outlets: Four.
10. Size Outlets: NPS 1/2 (DN 15).

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 water regulators with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

D. Install water control valves with inlet and outlet shutoff valves. Install pressure gages on inlet and outlet.

E. Install balancing valves in locations where they can easily be adjusted.

F. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
   1. Install thermometers and water regulators if specified.
   2. Install cabinet-type units recessed in or surface mounted on wall as specified.

G. Install Y-pattern strainers for water on supply side of each **water pressure-reducing valve**.

H. 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."

I. Install water hammer arresters in water piping according to PDI-WH 201.

J. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

K. Install drainage-type, trap-seal primer valves as lavatory trap or flushometer with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting.

L. Install trap-seal primer systems with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust system for proper flow.

3.2 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."

C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
1. Primary, thermostatic, water mixing valves.
2. Primary water tempering valves.
3. Trap-seal primer systems.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22.

3.4 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.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable flow set points of balancing valves.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

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, waste, and vent piping inside the building including vents through the roof:

B. This Section includes the following for soil gas vent piping within the building including the vent above the roof.
1. Pipe, tube, and fittings.
2. Special pipe fittings.

1.3 DEFINITIONS

A. ABS: 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 kPaor 5psi.

1.5 SUBMITTALS

A. Product Data: For pipe, tube, fittings, and couplings.

B. LEED Submittal:
1. Product Data for Credit EQ 4.1: For solvent cements and adhesive primers, including printed statement of VOC content.

C. 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. All cast iron piping and fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute (CISPS) and be listed by NSF International.

C. 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.

C. Underground, soil, waste, and vent piping shall be the following:
   1. PVC pipe, PVC socket fittings, and solvent-cemented joints. Pipe and fittings material in first subparagraph below are only available down to NPS 3 (DN 80). Either delete

subparagraph if sizes are smaller than NPS 3 (DN 80) or be prepared to accept pipe sizes larger than indicated on Drawings if these materials are selected by Contractor.

3.3 PIPING INSTALLATION

A. Basic piping installation requirements are specified in Division 22 Section "Common Work Results for Plumbing."

B. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.

C. Install cleanout fitting with closure plug inside the building in sanitary force-main piping.

D. Install wall-penetration fitting at each service pipe penetration through foundation wall. Make installation watertight.

E. 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.

F. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

G. 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.

H. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

I. Install underground PVC soil and waste drainage piping according to ASTM D 2321.

J. 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. Maximum spans below were taken from MSS SP-69 for water service and from model plumbing codes. Most restrictive piping and spacing dimensions are shown.

F. 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.

G. Install supports for vertical PVC piping every 48 inches (1200 mm).

H. 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 221319 - SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:
   1. Cleanouts.

B. Related Sections include the following:
   1. Division 22 Section "Storm Drainage Piping Specialties" for trench drains for storm water, channel drainage systems for storm water, roof drains, and catch basins.
   2. Division 22 Section "Plumbing Fixtures".

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Metal Floor Cleanouts:
   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 product by one of the following:
      a. Josam Company; Josam Div.
      b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
      c. Watts Drainage Products Inc.
      d. Zurn Plumbing Products Group; Specification Drainage Operation.
   4. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout.
   5. Size: Same as connected branch.
   6. Type: Threaded, adjustable housing.
   7. Body or Ferrule: Cast iron.
   8. Clamping Device: Not required.
   9. Outlet Connection: Inside calk.
   10. Closure: Plastic plug.
   11. Adjustable Housing Material: Cast iron with threads.
   12. Frame and Cover Material and Finish: Nickel-bronze, copper alloy.
   13. Frame and Cover Shape: Round.
   14. Top Loading Classification: Heavy Duty.
   15. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
   16. Standard: ASME A112.3.1.
   17. Size: Same as connected branch.

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 cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 100 feet for all piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Tests and Inspections:
   1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

3.3 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

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.

B. Provide cooperation with, and assistance to, the Commissioning Agent as specified under AResponsibilities@ in Division 01.

C. Provide cooperation with, and assistance to, the Testing and Balancing (TAB) Agent specified in Division 23 Section “Testing, Adjusting, and Balancing for HVAC.”

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 10 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. Plumbing job foreman.
      f. Controls job foreman.
      g. Project mechanical Engineer/designer.
      h. Job clerk.
      i. 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 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, Electrical.

C. Provide complete wiring system for automatic temperature controls as specified under Section Division 23 Section “Instrumentation and Controls for Mechanical Systems.”

D. Wiring shall conform to the requirements of the National Electrical Code.

1.8 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 APanel 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.

1.9 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.

1.10 TESTING

A. After the entire installation is completed and ready for operation, test the systems as outlined in Division 23 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.

1.11 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 Firestop Systems.” Coordinate with other trades for a consistent installation.

C. Refer to Architectural Drawings for locations of fire rated building assemblies.

1.12 ACCESS PANELS

A. Access panels required for items furnished under Division 23 shall be provided under this Division.

B. Manufacturer, and Model of standard doors: J. L. Industries, Inc., Model WB; Karp Associates, Inc., Model KDW; or The Williams Brothers Corporation of America, Model WB-DW.

C. Access panels shall be standard panels, 12 in. x 16 in. (305 mm x 406 mm) minimum unless indicated otherwise. Door shall be flush type of 14-gauge steel hinged to 16-gauge frame with drywall bead. Panels installed in areas of high moisture concentration, such as locker rooms, near plumbing fixtures, food preparation areas, or outdoors, shall be fabricated of paintable stainless steel or aluminum for corrosion resistance.

D. Doors and frames shall be factory primed. Latches shall be operated by tumbler lock, keyed alike, furnish 3 keys to the Owner.

E. Access panels in fire-rated construction shall have the same UL rating as the building assembly in which they are installed.

F. Provide access panels in building construction where required for access to duct access doors or other components such as valves, air vents, actuators, volume dampers, motorized dampers in ductwork, duct smoke detectors, and other related items.

1.13 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.

1.14 SUBSTITUTIONS

A. Comply with provisions of the Instructions to Bidders and General Conditions.

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.

1.15 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.

1.16 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 coordination drawings, 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.

1.17 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.

1.18 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.

1.19 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. Computer room air conditioning units.

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.
   d. Commissioning shall be completed.
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.
   d. Commissioning shall be completed.
3. Equipment:
   a. Equipment, including but not limited to boilers, heat exchangers, terminal heat transfer units, pumps, air handling units, condensing units, chillers, split system air conditioning equipment, and exhaust fans, 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.
   d. Commissioning shall be completed.
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.

1.2 REFERENCES

A. Division 01 Section “References”: 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 Section “Product Requirements”: 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. Vari-Green EC motor product line.
   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 Ainverter duty@, with winding insulation rated for 1600 volts and Class H (180EC) 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. Cerus Industrial, Inc.
   2. Allen-Bradley (division of Rockwell Automation).
   3. Cutler Hammer (division of Eaton Corporation).
   4. General Electric.
   5. Siemens.
   6. Square D (division of Schneider Electric).

B. Provide motor starters for motors provided under this Division of these Specifications.

C. Cerus Industrial “BAS” building automation HVAC starters are the basis of design. Features of starters/contactors, disconnects, and temperature controls shall be combined in a single package using these starters. Coordination with Automatic Temperature Controls supplier and installer is required to reduce total project costs.
   1. 3-phase starter features include:
      a. Multi-tap control power transformer (CPT) for universal control voltage.
      b. Motor circuit protector disconnect (MCP) with high interrupt rating and lockable operator handle.
      c. Contactors rated as high as 2.5 million electrical operations and 25 million mechanical operations.
      d. Anti-cycling feature.
      e. 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.
      f. 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.
      g. Damper and valve actuator control, to open the actuator before starting the fan or pump motor.
      h. Permissive auto control to disable auto inputs. Commonly used with a high pressure limit switch.
      i. Universal control inputs, including auto dry input, and wet input for voltages from 20 to 138 VAC or VDC.
      j. Power failure reset.
      k. Fireman’s override.
      l. NEMA 1 enclosure with prepunched knockouts. NEMA 3R, 4, 4X, and 12 as required.
      m. BACnet embedded communications option available.

n. UL Listed assembly.
o. 5-year warranty.
p. Factory printed label or engraved nameplate, designating the equipment served.

2. Single-phase starter (Cerus BAS-1P series) features include:
   a. Manually operated quick-make toggle mechanism lockable in the "Off" position, which shall also function as the motor disconnect.
   b. Hand/Auto switch, concealed behind sliding cover to discourage tampering.
   c. Capability to operate in both manual and automatic control modes. In automatic mode, the starter shall have the capability to integrate with a building automation system by providing terminals for run input, run status output, and fault output.
   d. Control terminals integrated in the starter.
   e. Power, run status, and fault LED pilot lights.
   f. Interposing run relay and current sensing status output relay.
   g. Voltage and dry inputs for auto run command.
   h. System override mode (fireman's, occupancy, or manual).
   i. Solid-state electronic overload with wide adjustment range and highly accurate digital motor protection, including protection for stall and locked rotor conditions. Class 10. Concealed adjustment behind sliding cover.
   j. Surface mount enclosure, UL Type 1, single gang box installation, with sliding covers for concealed items.
   k. Power Input: 1-phase, 110-240 VAC, 1-16 Amps, 0.1-1 HP.
   l. Universal Control Inputs: Voltage auto-run 10-130 VAC/DC to energize. Dry auto-run normally-open dry contact closure.
   m. Control Outputs: Proof of run and fault, normally-open 0.3 Amps at 125 VAC, 1 Amp at 24 VAC.
   n. Ambient operating temperature -5 to 140°F (-20 to 60°C).
   o. UL 508A Listed.
   p. 5-year warranty.

D. Feature Descriptions:
   1. Fireman's Override Input: Causes the starter to run the motor in any mode (Hand, Off or Auto) regardless of other inputs or lack of inputs either manual or auto. The purpose of the Fireman's Override input is to act as a smoke purge function. Fireman's Override has priority over the Emergency Shutdown input.
   2. Emergency Shutdown Input: Disables the starter from operating in either Hand or Auto mode regardless of other inputs either manual or auto.
   3. Phase Failure Protection: Initiates when phase loss is greater than 70% for 3 seconds or phase unbalance is greater than 50% for more than 5 seconds.
   4. Cycling Fault Protection: Activates whenever the starter is cycled at a rate of more than 1000 cycles in a one hour period. This feature shall be selectable to be disabled. Cycling fault shall cause overload LED to blink rapidly.

E. Contactors in starters shall be general purpose NEMA rated for connected H.P. (definite purpose starters not acceptable). Coordinate control voltage with Controls Contractor. Provide auxiliary contacts where required for interlocking of electrical equipment. Provide two-speed motor starters where indicated or required.

F. Single phase motors shall have one of the following factory wired methods of motor protection:
   1. Integral thermal overload protection in motor and cord with plug and receptacle in unit casing.

2. Integral thermal overload protection in motor and disconnecting switch mounted in or on casing as specified with equipment.
3. Switch with thermal overload protection for unprotected motors with switch serving as disconnect device.

G. 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 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 contactor shall meet the requirements of division 16.

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 Section “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. Test Plugs.

C. Thermometers and thermometer wells.

1.2 RELATED SECTIONS

A. Division 23 Section “Hydronic Piping.”

B. Division 23 Section “Instrumentation and Control for Mechanical Systems.”

1.3 REFERENCES

A. Division 01 Section “References”: 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.

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 Section “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 Section “Operation and Maintenance Data.”

B. Include instructions for calibrating instruments.

PART 2 - PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturers:
1. Weiss Series 4CTS.
2. Trerice 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: Cast aluminum or stainless steel.
2. Lens: Push-in Lexan polycarbonate, or clear glass or 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: Both psi and kPa.
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.

B. Pulsation Damper:
1. Manufacturers:
a. Weiss.
b. Trerice.
c. Marshalltown.
d. Amtek.
e. Dwyer.
2. Pressure snubber, brass with 1/4 inch (6 mm) NPT connections.

2.3 TEST PLUGS

A. Test Plug:
1. Manufacturers:
a. Peterson Equipment Co., Inc., APete=s Plugs@.
b. Weiss.
c. Flow Design, Inc.
d. Trerice.
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 275EF (-1 to 176EC).
b. Neoprene core for natural gas or LP gas service, temperature range -40 to 150EF (-40 to 65EC).
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 and other below-ambient applications, provide AXL@ plugs which include a 1-1/2" (38 mm) extension for insulated piping.

2.4 THERMOMETERS - DIAL

A. Manufacturers:
1. Weiss.
2. Trerice.
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: Both degrees F and degrees C.
8. Scale Range: 0 to100EF (-20 to 40EC) for chilled water, drycooler, and condenser water systems; 30 to 240EF (0 to 115EC) for hot water heating, and supply air systems.
9. Graduations: 2EF.
10. Air Duct Flange: Provide for duct applications.

C. Provide dial type except where digital type is indicated.

2.5 THERMOMETERS - DIGITAL

A. Manufacturers:

1. Weiss.

B. Thermometer: Weiss Vari-angle Digital Thermometer, high-impact black ABS plastic case, adjustable angle and swivel head. Light-powered, no batteries. Stem assembly shall be in full conformance with Fed. Spec GG-T-321D for industrial glass thermometers, or ASTM B40.3-1990 for bimetallic dial thermometers. Recalibration via potentiometer adjustment.
   1. Sensor type: Glass passivated thermistor.
   2. Size: 1/2 inch (12.5 mm) high LCD digits.
   3. Bulb: Provide extended bulb for socket extension in insulated pipe.
   4. Accuracy: 1 percent of reading or 1 degree, whichever is greater.
   5. Calibration: Switchable for degrees F and degrees C.
   6. Scale Range: -50 to 300EF (-45 to 150EC).
   7. Graduations: 1/10 degree between -19.9 to 199.9EF (-28 to 93EC).
   8. Ambient Operating Range: -30 to 140EF (-35 to 60EC).
   9. Ambient Temperature Error: Zero.
   10. Allowable Humidity: 0 to 100% RH.
   11. Update: 10 seconds.
   12. Light Requirement: 10 Lux (1 foot-candle).
   13. Air Duct Flange: Provide for duct applications.

C. Provide outdoor waterproof cover for wet locations.

D. May be used as an alternative to dial thermometers.

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; use needle valves for steam 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 pressure gauges with pulsation dampers. Extend nipples to allow clearance from insulation.

F. 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.

G. Install thermometers in air duct systems on flanges.

H. Fill thermometer sockets with heat transfer paste.

I. Install thermometer sockets adjacent to controls systems thermostat, transmitter, or sensor sockets.

J. Locate duct mounted thermometers minimum 10 feet (3 m) downstream of mixing dampers, coils, or other devices causing air turbulence.

K. Coil and conceal excess capillary on remote element instruments.

L. Provide instruments with scale ranges selected according to service with largest appropriate scale.

M. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

N. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

O. Locate test plugs where indicated.

P. Provide pressure gauge at high point of system for setting of cold water make-up pressure reducing valve.

Q. Provide pressure gauge at connection to bladder type expansion tank for setting of air side pre-charge pressure.

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.

D. Flashing and sealing equipment and pipe stacks.

E. Non-penetrating roof mounted pipe support system.

1.2 RELATED SECTIONS

A. Division 07 Section “Through-Penetration Firestop Systems”: Joint seals for piping and duct penetration of fire rated assemblies.

B. Division 09 Section “Painting.”

C. Division 23 Section “Vibration and Seismic Controls for HVAC Piping and Equipment.”

D. Division 23 Section “HVAC Piping Insulation.”

E. Division 23 Section “HVAC Equipment Insulation.”

F. Division 23 Section “Facility Fuel-Oil Piping.”

G. Division 23 Section “Refrigerent 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 B Specification for Electrodeposited Coatings of Zinc on Iron and Steel.

G. ASTM C642 B Test Method for Specific Gravity, Absorption, and Voids in Hardened Concrete.

H. ASTM C672 B Test Methods for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.

I. ASTM D412 B Test Methods for Vulcanized Rubber and Thermoplastic Elastomers B Tension.

J. ASTM D395 B Standard Test Methods for Rubber Property B Compression Set.

K. ASTM D573 B Test Method for Rubber B Deterioration in an Air Oven.

L. ASTM D746 B Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

M. ASTM D2240 B Test Method for Rubber Property B 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 70 B National Electrical Code

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 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.

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. Roof Support Blocks/Non-Penetrating Roof-Mounted Pipe Support System:
   a. Cooper B-Line - Dura-Blok line.
   b. Miro Industries.
   c. Unistrut (division of Tyco) - Unipier line.
6. Cushion Clamps:
   a. Hydra-Zorb Company.
   b. Cooper B-Line.
   c. Thomas & Betts - Superstrut line.
   d. Unistrut (division of Tyco).
7. Insulated Pipe Couplings:
   a. Klo-Shure Corporation.
   b. Cooper B-Line - Armafix line.
8. 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. Hangers, clamps, and supports located outdoors or otherwise exposed to weather, or in wet or washdown areas, shall be hot-dipped galvanized steel or 300-series stainless steel. Struts may be extruded aluminum. Threaded rods, nuts, and washers may have standard galvanizing if hot-dipped galvanized is not available.
   1. Hot-dipped galvanized steel shall have a nominal zinc coating of 2.6 mil thickness and 1.5 oz./sq.ft coating weight.
   2. In lieu of galvanizing, strut systems and their accessories may have Unistrut Perma-Green III electrodeposited thermoset acrylic coating, or be epoxy-coated equal to B-Line-s Dura-Green or Dura-Copper coatings.

3. Lesser coatings for struts and clamps, such as pre-galvanizing (0.75 mil thickness), electroplated zinc (0.2 to 0.5 mil thickness), and yellow zinc dichromate coating, are not acceptable in these locations.

E. 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.

F. Cushion Clamps for Un-insulated Lines: Plastic cushion shall be Dupont Hytel plastic, 5555HS plastic elastomer, warranted from -40 F to 275 F.

G. 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.

H. 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. Fuel Oil 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.

B. Exhaust Piping:
1. Conform to ASME B31.1, ASTM F708, MSS SP58, MSSSP69 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 Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
4. Hangers for Pipe Sizes 5 Inches (125 mm) and Over: Adjustable steel yoke, cast iron roll, double hanger.
5. Multiple or Trapeze Hangers for Pipe Sizes to 4 inches (100 mm): Steel channels with welded spacers and hanger rods.
6. Multiple or Trapeze Hangers for Pipe Sizes 5 Inches (125 mm) and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.
7. Wall Support for Pipe Sizes to 3 Inches (70 mm): Cast iron hook.
8. Wall Support for Pipe Sizes 4 to 5 Inches (100 to 125 mm): Welded steel bracket and wrought steel clamp.
9. Wall Support for Pipe Sizes 6 Inches (150 mm) and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll.
10. Vertical Support: Steel riser clamp.
11. Floor Support for Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
12. Floor Support for Pipe Sizes 5 Inches (125 mm) and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
13. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Refrigerant Piping:
1. Conform to ASME B31.5, 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 Pipe Sizes 2 Inches (50 mm) and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 Inches (75 mm): Cast iron hook.
6. Wall Support for Pipe Sizes 4 Inches (100 mm) and Over: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. 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 FLASHING

A. Metal Flashing: 26 gauge (0.5 mm) thick galvanized steel.

B. Metal Counterflashing: 22 gauge (0.8 mm) thick galvanized steel.

C. Lead Flashing:
1. Waterproofing: 5 lb/sq ft (24.5 kg/sq m) sheet lead
2. Soundproofing: 1 lb/sq ft (5 kg/sq m) sheet lead.

D. Flexible Flashing: 47 mil (1.2 mm) thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gauge (0.8 mm) minimum; 16 gauge (1.5 mm) at fire resistant elements.

2.5 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.

2.6 NON-PENETRATING ROOF-MOUNTED PIPE SUPPORT SYSTEM

A. Roof Support Blocks: Cooper B-Line Inc. - Dura-Blok product line.

B. Curb Base:
1. 100% recycled rubber and polyurethane prepolymer, UV resistant.
2. Support capacity of 2500 pounds per linear foot of support. Note: Consult roofing manufacturer; the weakest point may be the insulation board beneath the roof membrane.
3. Each base shall have a reflective yellow stripe.
4. Base Dimensions: 6 inches wide, 4 inches tall, with length as selected by the manufacturer for the load and roof conditions.
5. Material Properties:

Property	Value	Standard
a. Density	0.6 oz/cu in	ASTM C642

b.	Durometer Hardness	65A " 7	ASTM D2240
c.	Tensile Strength	210 psi minimum	ASTM D412
d.	Compression Deformation 10% at 70psi and 68•F		ASTM D395
e.	Brittleness at Low Temp	-401F	ASTM D746
f.	Freeze and thaw when exposed to deicing chemicals	No loss after 50 cycles	ASTM C672
g.	Coefficient of Thermal		
h.	Expansion	8 x 10-6 in/in/•F (min)	ASTM C531
i.	Weathering, 70 hours at 12•F		ASTM D573
	1) Hardness retained	100% ("5%)	
	2) Compressive strength	100% ("5%)	
	3) Tensile strength	100% ("5%)	
	4) Elongation retained	100% ("5%)	

6. Note: An acceptable substitute is the Unistrut Unipier system, which has bases of polycarbonate (UV-resistant plastic), hot-dipped galvanized steel, or stainless steel. The properties of these are different from the rubber block type. In particular, the weight capacity per foot of the polycarbonate bases is less. Consult the factory.

C. Steel Frame: Steel strut, hot-dip galvanized per ASTM A653, 14 ga. strut for C and CE series, 12 ga strut for CB and CS series. Struts may be epoxy-coated equal to B-Line=s Dura-Green or Dura-Copper coatings in lieu of galvanizing.

D. Attaching Hardware: Zinc-plated threaded rod, nuts and attaching hardware per ASTM B633.

E. Multi-Pipe/Equipment Support: C-Port single-base C-Series models with 13/16" strut, or dual-base CB-Series ABridge Type@ with 1-5/8" strut. Strut attached to base for fastening of accessories. Select length to suit number of pipes or equipment fastened, allowing 1-inch of space at either end of support.

F. Extendible Height Support: C-Port Model CE10-8, CE10-12, or CE10-16, with 8-inch, 12-inch or 16-inch height to suit application. 13/16" strut for fastening accessories. Two 1/2-inch all-thread rods per 9-inch base (select base length as required), with nuts and washers. Standard load rating is 200 pounds per foot due to point loading at support rods; CLDP10 11-ga. load distribution plates may be used for increased loading. For heavier loads, additional height options and variable angle options, use C-Port CS-Series with B22 channel to field-fabricate an AH@ frame support for additional stability.

G. Roller Support: C-Port CR-Series with 12-inch overall height, with B3114-3-1/2 pipe roll with sockets, for piping outside diameters up to 3-1/2". Two 1/2-inch all-thread rods per 9-inch base, with nuts and washers. Standard load rating is 200 pounds per foot due to point loading at support rods; CLDP10 11-ga. load distribution plates may be used for increased loading.

H. Variable Angle/Height Support: C-Port CS-Series with 1-5/8" strut channel, 1/4"-thick x 5-3/4" long adapter leg to accommodate 1-5/8" strut, and connecting hardware.

I. Pipe/conduit clamps shall be channel style, B-Line B2000 or B2400 series or approved equal, made of galvanized steel (or steel with coating to provide equivalent protection for outdoor use). For refrigeration pipes, provide B-Line Vibra-Cushion or Vibra-Clamp internally cushioned clamps. Provide copper plated pipe support where metal is in contact with copper pipe.

J. Provide extendible height supports when spacing above roof, or sloping of pipe to drain, or both, are required.

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, air handling units, utility set fans, compressors, base mounted pumps, boilers, converters, heat exchangers, storage tanks and expansion tanks.

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 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weatherproofed or waterproofed walls, floors, and roofs.

B. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms, installed in accordance with manufacturer's instructions for sound control.

C. Provide curbs for mechanical roof installations 14 inches (350 mm) minimum high above roofing surface. Flash and counterflash with sheet metal; seal watertight. Attach counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

D. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 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.

3.7 PIPING ABOVE ROOF

A. Where possible, support piping from building structural steel and grillage.

B. Where necessary, use non-penetrating roof-mounted pipe support system.

3.8 NON-PENETRATING ROOF-MOUNTED PIPE SUPPORT SYSTEM

A. Install in accordance with manufacturer-s instructions and recommendations.

B. If roof has stone or gravel ballast, remove ballast around and under pipe support.

C. Consult roofing manufacturer for roof membrane and insulation compression capacities. If necessary, a compatible sheet of roofing material (rubber pad) may be installed under rooftop support to disperse concentrated loads and add further membrane protection.

D. Use properly sized clamps to suit pipe sizes.

3.9 SCHEDULES

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
8 to 12	200 to 300	14	4.25	7/8	22
14 and over	350 and over	20	6	1	25
Polypropylene Piping					

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

END OF SECTION 230529

SECTION 230548 – VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Vibration isolation.

1.2 RELATED SECTIONS

A. Division 23 Section “Expansion Fittings and Loops for HVAC Piping.”

B. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

C. Division 26 Section “Electrical”: Electrical characteristics and wiring connections.

1.3 PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated elsewhere in these specifications, provide vibration isolation on motor driven equipment over 0.5 HP (0.35 kW), plus connected piping and ductwork.

B. Provide Minimum Static Deflection of Isolators for Equipment as Indicated:
   1. Upper Floors, Normal
      a. Under 400 rpm: 3.5 inch (90 mm)
      b. 400 - 600 rpm: 3.5 inch (90 mm)
      c. 600 - 800 rpm: 2 inch (50 mm)
      d. 800 - 900 rpm: 1 inch (25 mm)
      e. 1100 - 1500 rpm: 0.5 inch (12 mm)
      f. Over 1500 rpm: 0.2 inch (5 mm)
   2. Upper Floors, Critical
      a. Under 400 rpm: 3.5 inch (90 mm)
      b. 400 - 600 rpm: 3.5 inch (90 mm)
      c. 600 - 800 rpm: 3.5 inch (90 mm)
      d. 800 - 900 rpm: 2 inch (50 mm)
      e. 1100 - 1500 rpm: 1 inch (25 mm)
      f. Over 1500 rpm: 0.5 inch (12 mm)

C. Upper floor locations shall be considered critical unless otherwise indicated.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures”.

B. Shop Drawings: Locate vibration isolators, with static and dynamic load on each.

C. Product Data: Provide schedule of vibration isolator type with location and load on each. Indicate static deflection expected under the actual load, and minimum static deflection.

D. Manufacturer's Installation Instructions: Indicate special procedures and setting dimensions.

E. Manufacturer's Certificate: Certify that isolators are properly installed and adjusted to meet or exceed specified requirements.

1.5 REQUIREMENTS

A. Outdoor Equipment: Provide restraint to withstand the force of a 100 mph wind applied to any exposed surface of the isolated equipment. Provide bolt holes for attachment to equipment and to supports.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures”.

B. Record actual locations of hangers including attachment points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Mason Industries, Inc.

B. Amber/Booth Co.

C. Kinetics Noise Control.

D. Korfund Dynamics Corp.

E. Vibration Eliminator Co.

F. Vibration Mountings and Controls, Inc.

2.2 GENERAL

A. Metal parts installed outdoors shall be corrosion resistant after fabrication. Galvanizing shall meet ASTM Salt Spray Test Standards and Federal Test Standard No. 14.

B. Isolator types are scheduled to establish minimum standards. At the Contractor’s option, labor-saving devices may be an integral part of isolators, to provide initial lift of equipment to operating height, to hold piping at fixed elevations during installation and initial filling, and similar installation advantages. Accessories and seismic restraint features shall not degrade the isolation performance of the isolators.

C. Static deflections indicated are the minimum under actual load. Isolators selected solely on the basis of rated deflections are not acceptable.

2.3 VIBRATION ISOLATORS

A. Spring Hanger:
   1. Spring Isolators:
      a. For Exterior and Humid Areas: Provide hot dipped galvanized housings and neoprene coated springs.
      b. Code: Color code springs for load carrying capacity.
   2. Springs: Minimum horizontal stiffness equal to 75 percent vertical stiffness, with working deflection between 0.3 and 0.6 of maximum deflection.
   3. Housings: Incorporate rubber hanger with threaded insert.
   4. Misalignment: Capable of 20 degree hanger rod misalignment.

B. Rubber Hanger:
   1. Mason Model HD.
   2. Construction: Double-deflection LDS (Low Dynamic Stiffness) bridge-bearing natural rubber or neoprene element, with projecting bushing to prevent steel-to-steel contact. Neoprene bonded to steel plates on top and bottom, with hole thru middle so that rod weight bears on top of element, putting element in compression when equipment weight is added. Steel housing with upper hole for rod.
   3. Field-furnished rods, nuts, and washers.
   4. Color code rubber or neoprene element for load carrying capacity.
   5. Deflection of 0.35 inches (9 mm) at maximum rated weight.

C. Neoprene Pad Isolators:
   1. Rubber or neoprene waffle pads.
      a. 30 durometer.
      b. Minimum 1/2 inch (13 mm) thick.
      c. Maximum loading 40 psi (275 kPa).
      d. Height of ribs shall not exceed 0.7 times width.
   2. Configuration: Single layer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install isolation for motor driven equipment.

C. Bases: Set steel bases for 1 inch (25 mm) clearance between housekeeping pad and base. Adjust equipment level.

D. Bolt base-type spring or rubber mounts to the equipment. Bolt to the floor, concrete housekeeping pad, or other support base or frame indicated, unless otherwise indicated.

E. Install spring hangers without binding.

F. On closed spring isolators, adjust so side stabilizers are clear under normal operating conditions.

G. Prior to making piping connections to equipment with operating weights substantially different from installed weights, block up equipment with temporary shims to final height. When full load is applied, adjust isolators to load to allow shim removal.

H. Provide resiliently mounted equipment, piping, and ductwork with seismic snubbers. Snub equipment designated for post disaster use to 0.05 inch (1.5 mm) maximum clearance. Other snubbers shall have clearance between 0.15 inch (4 mm) and 0.25 inch (7 mm). Data Center air conditioning units are included in those items designated for post-disaster use.

I. Support piping connections to isolated equipment (including equipment which is internally isolated at the factory) resiliently as follows:
   1. Up to 4 Inch (100 mm) Diameter: First three points of support.
   2. 5 to 8 Inch (125 to 200 mm) Diameter: First four points of support.
   3. Select three hangers closest to vibration source for minimum 1.0 inch (25 mm) static deflection or static deflection of isolated equipment. Select remaining isolators for minimum 1.0 inch (25 mm) static deflection or 1/2 static deflection of isolated equipment.

J. Connect wiring to isolated equipment with flexible hanging loop.

K. Sheetmetal ducts and air plenums within mechanical rooms or within a distance of 50 feet total duct length of connected vibration isolated equipment (whichever is longer) (including equipment which is internally isolated at the factory) shall be isolated from the building structure by spring hangers.

L. Connect hanger rods for vibration isolated supports to structural beams or joists, not from the floor slab or roof deck between beams and joists. Provide intermediate support members as required.

M. Resiliently isolated pipes shall not contact the building construction or other equipment.

N. No equipment unit shall bear directly on vibration isolators unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.

O. Unless otherwise indicated, there shall be a minimum operating clearance of 1-1/2" (37.5 mm) between inertia bases or steel frame bases and the floor beneath the equipment. Position isolator mounting brackets and adjust isolators so that the required clearance is maintained. Check the clearance space to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.

P. If any rotating equipment causes excessive noise or vibration when properly installed on the specified isolators, provide rebalancing, realignment, and/or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer-s specifications for the equipment.

3.2 MANUFACTURER'S FIELD SERVICES

A. Examine systems under provisions of Division 01 Section “Quality Requirements”.

B. Inspect isolated equipment after installation and submit report. Include static deflections.

3.3 SCHEDULES

EQUIPMENT ISOLATION SCHEDULE

ISOLATED EQUIPMENT	BASE Type Thickness	ISOLATOR Type Deflection
Computer Room Air Conditioning Units	Equipment Frame	Internal, factory furnished

END OF SECTION 230548

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe Markers.

1.2 RELATED SECTIONS

A. Division 09 Section “Painting”: Identification painting.

1.3 REFERENCES

A. Division 01 Section “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.

1.4 SUBMITTALS

A. Division 01 Section “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.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under Division 01 Section “Closeout Procedures.”

B. Record actual locations of tagged valves; include valve tag numbers.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “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. Plastic Tags:
   1. Manufacturer: Seton Identification Products, a division of Tricor.
   2. Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inches (38 mm) diameter.

B. 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.

C. 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.

D. Tag Chart: Typewritten letter size list in anodized aluminum frame with plexiglass cover.

2.3 STENCILS

A. Manufacturer: Seton Identification Products, a division of Tricor.

B. Stencils: With clean cut symbols and letters of following size:
   1. Up to 2 inch (51 mm) Outside Diameter of Insulation or Pipe: 1/2 inch (13 mm) high letters.
   2. 2-1/2 to 6 inches (64-150 mm) Outside Diameter of Insulation or Pipe: 1 inch (25 mm) high letters.
   3. Over 6 inches (150 mm) Outside Diameter of Insulation or Pipe: 1-3/4 inches (44 mm) high letters.
   4. Ductwork and Equipment: 1-3/4 inches (44 mm) high letters.

C. Stencil Paint: As specified in Division 09 Section “Painting”, semi-gloss enamel, colors and lettering size conforming to ASME A13.1.

2.4 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.

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 Section “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. Apply stencil painting in accordance with Division 09 Section “Painting.”

G. Identify items of mechanical equipment such as air conditioners, drycoolers, and water treatment devices with plastic nameplates. Small devices, such as in-line pumps and actuators, may be identified with tags.

H. Identify control panels and major control components outside panels with plastic nameplates.

I. Identify valves in main and branch piping with metal tags.

J. Tag automatic controls, instruments, and relays. Key to control schematic.

K. 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.

L. 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.

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 230593 – TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, Adjustment, and Balancing of Air Systems.

B. Measurement of Final Operating Condition of HVAC Systems.

1.2 RELATED SECTIONS

A. Division 01 Section “Quality Requirements”: Testing laboratory services: Employment of testing agency and payment for services.

1.3 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.

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Submit name of Testing, Adjusting, and Balancing (TAB) Agency for approval within 14 days after award of Contract.

C. 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.

D. Preliminary Report Submittals:
   1. Prior to commencing work of this Section, and no more than 14 days after approval of TAB Agency qualifications, 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.

E. 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.

F. 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.

G. Include detailed procedures, agenda, sample report forms and copy of AABC National Project Performance Guaranty prior to commencing system balance.

H. Test Reports: Indicate data on AABC National Standards for Total System Balance forms, forms prepared following ASHRAE 111, NEBB forms, or forms containing information indicated in Schedules.

1.5 QUALITY ASSURANCE

A. Perform total system balance in accordance with AABC National Standards for Field Measurement and Instrumentation, Total System Balance; ASHRAE 111; orNEBB Procedural Standards for Testing, Balancing and Adjusting of Environmental Systems.

1.6 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 one of those listed under paragraph 3.01 AGENCIES in this Section.

B. Perform Work under supervision of AABC Certified Test and Balance Engineer NEBB Certified Testing, Balancing and Adjusting Supervisor] [or] [registered Professional Engineer experienced in performance of this Work and licensed [at the place where the Project is located.

C. The approved Agency shall be in no way affiliated with the installing Subcontractor.

1.7 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.

1.8 SCHEDULING

A. Schedule and provide assistance in final adjustment and test of life safety system with Fire Authority.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 AGENCIES

A. Tekon Technical Consultants, Rochester, NH. Contact: Charles Corlin, (603) 335-3080.

B. Maine Air Balance, Brewer, ME. Tel. (207) 989-0533.

C. Whitetail Air Balance LLC, Lisbon, ME. Contact: Jim Davis, (207) 577-9292.

D. Harriman, Auburn, ME. Contact: Norman Varney, (207) 784-5100.

E. 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. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. 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.

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, outside air, 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. Where available fan 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.

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 PROJECT CLOSEOUT

A. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Architect.

B. Retests: If random tests elicit a measured flow deviation of ten percent or more from, [or a sound level of 2 Db or more greater than,] 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.

3.8 SCHEDULES

A. Equipment Requiring Testing, Adjusting, and Balancing:
   1. Air Cooled Refrigerant Condensers
   2. Computer Room Air Conditioning Units
   3. Air Coils
   4. Fans

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. Air Cooled Condenser:
   a. Identification/number
   b. Location
   c. Manufacturer
   d. Model number
   e. Serial number
   f. Entering DB air temperature, design and actual
   g. Leaving DB air temperature, design and actual
   h. Number of compressors
7. Cooling Coil Data:
   a. Identification/number
   b. Location
   c. Service
   d. Manufacturer
   e. Air flow, design and actual
   f. Entering air DB temperature, design and actual
   g. Entering air WB temperature, design and actual
   h. Leaving air DB temperature, design and actual
   i. Leaving air WB temperature, design and actual
   j. Water flow, design and actual
   k. Water pressure drop, design and actual
   l. Entering water temperature, design and actual
   m. Leaving water temperature, design and actual
   n. Saturated suction temperature, design and actual
   o. Air pressure drop, design and actual
8. 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

9. Electric Duct Heater:
   a. Manufacturer
   b. Identification/number
   c. Location
   d. Model number
   e. Design kW
   f. Number of stages
   g. Phase, voltage, amperage
   h. Test voltage (each phase)
   i. Test amperage (each phase)
   j. Air flow, specified and actual
   k. Temperature rise, specified and actual
10. 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
11. 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
12. 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

13. 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
14. Air Distribution Test Sheet:
    a. Air terminal number
    b. Room number/location
    c. Terminal type
    d. Terminal size
    e. Area factor
    f. Design velocity
    g. Design air flow
    h. Test (final) velocity
    i. Test (final) air flow
    j. Percent of design air flow

END OF SECTION 230593

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”: Ductwork.

1.3 REFERENCES

A. Division 01 Section “References”: 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 C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.

F. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation.

G. ASTM C921 - Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

I. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

J. ASTM E162 - Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

L. NAIMA National Insulation Standards.

M. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials.

N. SMACNA - HVAC Duct Construction Standards - Metal and Flexible.

O. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

A. Division 01 Section “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 Section “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 Section “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.

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. Vac Systems International (product: Tough Coat acrylic polymer mechanical insulation repair coating).

2.2 GLASS FIBER, FLEXIBLE

A. Insulation: ASTM C553; flexible, noncombustible blanket.
1. 'K' ('Ksi') value: ASTM C518, 0.27 at 75EF (0.039 at 24EC).
2. Maximum service temperature: 250EF (121EC) faced and 350EF (176EC) unfaced.
3. Maximum moisture absorption: 0.20 percent by volume.
4. Minimum density: 1.0 lb/cu.ft (16 kg/m^3).

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. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

E. 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 75EF (0.036 at 24EC).
2. Maximum service temperature: 450EF (232EC).
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, white color.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Division 01 Section “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 Section “Quality Requirements”: Manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. 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.

D. 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.

E. 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.

F. Ductwork Exposed in Mechanical Rooms and Finished Spaces: Provide glass fiber rigid insulation with vapor barrier jacket.

G. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift ductwork off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

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. 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.

P. Mechanical fasteners shall not be riveted or screwed to the duct and shall not penetrate the metalwork.

Q. 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 PAINTING AND IDENTIFICATION

A. Paint in accordance with Division 09 Section “Painting.”

3.4 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
Exhaust and relief ductwork from exterior building openings (such as louvers and roof hoods) to 4 feet (1.2 m) interior of motorized damper or backdraft damper	Glass Fiber, Flexible (only if ductwork is concealed)	Yes	1 1/2" (38.1 mm)
	Glass Fiber, Rigid	Yes	1" (25.4 mm)
Outside air intake ductwork	Glass Fiber, Flexible (only if ductwork is concealed)	Yes	2 layers of 1 1/2"(38.1 mm) with staggered joints
	Glass Fiber, Rigid	Yes	2 layers of 1" (25.4 mm) with staggered joints
Mixed air ductwork	Glass Fiber, Flexible (only if ductwork is concealed)	Yes	2 layers of 1 1/2"(38.1 mm) with staggered joints
	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 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)

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 09 Section “Painting”: Painting insulation jacket.

C. Division 23 Section “Identification for HVAC Piping and Equipment.”

1.3 REFERENCES

A. Division 01 Section “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 Section “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 Section “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 Section “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. Elastomeric Foam Products:
1. Armacell LLC.
2. K-Flex USA.
3. No substitutions.

B. Glass and Mineral Fiber Products:
1. Knauf Insulation.
2. Certainteed Corporation.
3. Johns Manville.
4. Owens Corning.
5. No substitutions.

C. 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. IIG Industrial Insulation Group LLC, a Calsilite/Johns Manville joint venture (product: calcium silicate insulation for high-density inserts).
4. Johns Manville (products: Super-Seal acrylic polymer coatings).
5. Pabco/Childers Metals, division of ITW Insulation Systems (products: metal jacket systems,

and accessories).
6. Pittsburgh Corning (product: cellular glass insulation for high-density inserts).
7. Vac Systems International (product: Tough Coat acrylic polymer mechanical insulation repair coating).

2.2 ELASTOMERIC FOAM

A. Products:
1. Armacell: AP Armaflex pipe and sheet insulation.
2. K-Flex USA: Insul-Tube and K-Flex LS pipe insulation, and Insul-Sheet S2S and K-Flex LS sheet insulation.
3. No substitutions.

B. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
1. 'K' ('Ksi') value: ASTM C177; 0.277 Btu-in/(hr-sq.ft-EF) at 75°F (0.04 W/m-K at 24°C).
2. Minimum service temperature: -70°F (-57°C) (flexible to -20°F (-29°C)).
3. Maximum service temperature: 220°F (104°C).
4. Maximum moisture absorption: ASTM C209, 0.2% by volume; or ASTM D1056, 5% by weight.
5. Moisture vapor transmission: ASTM E96; 0.08 perm-inches (0.116 ng/(s-m-Pa)).
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

D. Insulated Hanger Inserts: At Contractor-s option, Armacell Armafix IPH insulated pipe hanger inserts may be used at hanger locations.
1. Engineered from Armaflex insulation, with inserts of CFC-free PPUR/PIR polyurethane foam insulation bearing segments.
2. Outer shell of 30 mils (0.76 mm) -thick painted aluminum.
3. Self-adhesive closure strip.
4. Provide Armaflex insulation tape, wrapped around the IPH prior to placing in the hanger.

2.3 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.

2.4 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, 30 mil (0.76 mm) for outdoor 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.

B. ABS Plastic:
   1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
      a. Minimum service temperature: -40°F (-40°C).
      b. Maximum service temperature of 180°F (82°C).
      c. Moisture vapor transmission: ASTM E96; 0.012 perm-inches.
      d. Thickness: 30 mil (0.76 mm).
      e. Connections: Brush on welding adhesive.

C. Fibrous Glass Fabric:
   1. Cloth: Heat treated to remove most organic binders. May be factory-impregnated with an inorganic fire-retardant rewettable adhesive, at Contractor's option.
   2. Weight: 9 oz/sq yd (305 g/sq m) minimum.
   3. Blanket: 1.0 lb/cu ft (16 kg/cu m) density.
   4. Weave: 10x20 per inch (390x780 per meter).
   5. Service Temperature: 1000°F (538°C).

D. Aluminum Jacket: ASTM B209, ASTM B209M.
   1. Thickness: 0.016 inch (0.40 mm) sheet.
   2. Finish: Smooth.
   3. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
   4. Fittings: 0.016 inch (0.4 mm) thick die shaped fitting covers with factory attached protective liner.
   5. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.015 inch (0.38 mm) thick aluminum.

E. Stainless Steel Jacket: ASTM A167 Type 304 stainless steel.

1. Thickness: 0.010 inch (0.25 mm).
2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch (10 mm) wide; 0.010 inch (0.25 mm) thick stainless steel.

2.5 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.
3. Inserts at Clamps: Armacell Armafix insulation inserts. AP/Armaflex foam insulation, with rigid polyurethane foam inserts at clamping area, and 30-mil thick painted aluminum jacket. Self-adhesive closure providing foam-to-foam bond.

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.

2.6 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 Section “Quality Requirements”: Manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Provide insulation for surfaces of piping, as indicated and specified. Insulation values shall meet or exceed the requirements of ASHRAE 90.1-2001, State Energy Codes, 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. Branches to Expansion Tanks: For chilled water systems, insulate completely. For hot water systems, insulate from the connection at the main to at least 10 feet (3 m) toward the tank.

L. 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.
   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. 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.

M. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Division 7.

N. Pipe Exposed in Mechanical Equipment Rooms (less than 10 feet (3 meters) above finished floor): Finish with PVC or ABS jacket and fitting covers.

O. Pipe Exposed in Finished Spaces: Finish with PVC or ABS jacket and fitting covers.

P. Exterior Applications:
   1. Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass-mesh-reinforced vapor barrier cement.
   2. Hot Water and Steam Piping: Cover with aluminum or stainless steel jacket and fitting covers with seams located on bottom side of horizontal piping.
   3. Other Piping: Cover with PVC jacket and fitting covers with seams located on bottom side of horizontal piping.

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. Valve hand wheels.
   2. Vibration isolating connections.
   3. Adjacent insulation.
   4. ASME stamps.

3.5 PIPING INSULATION

A. Pipe Insulation (Except Elastomeric 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 l-l/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. Elastomeric Foam Insulation: Bond cuts, butt joints, ends, and longitudinal joints with adhesive. Miter 90-degree turns and elbows, tees, and valve insulation. Where pipes penetrate fire walls, provide mineral-fiber insulation inserts and sheetmetal sleeves. Insulate flanges, unions, valves, and fittings in accordance with manufacturer-s published instructions. Apply two coats of vinyl lacquer finish to elastomeric foam insulation before applying PVC jacket in outside locations.

C. Seal surfaces of fibrous insulation to prevent release of fibers.

D. 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 PAINTING AND IDENTIFICATION

A. Paint in accordance with Division 09 Section “Painting”. Piping identification shall be as specified in other sections.

3.7 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
Air Conditioning Condensate Drain Located Inside Building	Elastomeric Foam	N/A	0.5"	0.5"	1.0"	1.0"	1.0"
Cooling Systems (Drycooler or Condenser) Piping Located Inside Building	Elastomeric Foam	N/A	0.5"	1.0"	1.0"	1.0"	1.5"
Refrigerant Suction and Liquid Piping	Elastomeric Foam	N/A	0.5"	0.75"	1.0"	1.0"	1.0"
Refrigerant Hot Gas Bypass Piping, and Hot Gas Discharge Piping to Condenser, Located Inside Building	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 modifications and expansions to the Owner's existing Delta Controls network, to provide 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. Operator graphical interface is the Owner's existing workstation location on the USM campus in Portland, ME.

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.

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. Dew Point Temperature: Plus or minus 3 deg F (1.5 deg C).
    h. Temperature Differential: Plus or minus 0.25 deg F (0.15 deg C).
    i. Relative Humidity: Plus or minus 5 percent.
    j. Electrical: Plus or minus 5 percent of reading.

1.5 SUBMITTALS

A. Qualification Data: For Installer and manufacturer.

B. 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 interface equipment, control units and panels, transducers/transmitters, sensors, actuators, valves, and relays/switches.
2. 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.

C. 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 units.
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.

D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with the open protocol standard compatible with the Owner's existing Delta system, ASHRAE Standard 135 (BACnet).

E. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
2. Program Software Backup: On a magnetic media or CD, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For mechanical instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Maintenance instructions and lists of spare parts for each type of control device.
2. Interconnection wiring diagrams with identified and numbered system components..
3. Inspection period, cleaning methods and materials, and calibration tolerances.
4. 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 per 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. 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.

1.8 COORDINATION

A. Coordinate location of 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. Power controls from designated emergency-power circuits.

1.9 EXTRA MATERIALS

A. (Not Used.)

PART 2 - PRODUCTS

2.1 PRICING

A. The Basis of Design manufacturer/installer is listed first, as the manufacturer of the Owner's existing system, which any control system provided shall be compatible with.

B. Submit pricing in the base bid for the Basis of Design manufacturer/installer, listed as a separate line item. List pricing for alternate manufacturer/installers as separate line items. The Owner will select the manufacturer/installer based on pricing and compatibility.

2.2 ACCEPTABLE SUPPLIERS

A. Acceptable Manufacturers and Installers:
   1. Basis of Design: Delta Controls, installed by IB Controls Inc., 3 Pope Road, Windham, ME 04062, telephone (207) 893-0080.
   2. No substitutions.

B. System components shall generally be the products of the manufacturer 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 existing 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.

2.3 UNACCEPTABLE BIDDERS

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.

2.4 DDC EQUIPMENT

A. Operator Workstation: Existing, at the Owner's maintenance office on the USM campus in Portland, ME.

B. Application Software:
1. Existing operating system shall be upgraded to latest control system.
2. I/O capability from operator station.
3. Automatic system diagnostics; monitor system and report failures.
4. Dynamic color graphic displays.
5. Alarm processing, messages, and reactions.
6. Trend logs retrievable in spreadsheets and database programs.
7. Alarm and event processing.
8. Object and property status and control.
9. Automatic restart of field equipment on restoration of power.
10. 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.
11. Utility and weather reports.
12. 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. Power to the temperature control panels shall be through Astand-by@ power circuits which are powered through the building=s emergency generator. It is the design intent to have the new portions of the ATC system, including damper and valve actuators, powered by Astand-by@ power circuits to ensure that the system is fully functional when the building is operating on generator power. Power to each ATC panel shall be from the corresponding automatic transfer switch zone.
1. The following HVAC equipment will be powered by Astand-by@ circuits and shall remain in control when the building is operating on generator power. Closely coordinate with Electrical Contractor:
    a. Data Center computer room air conditioners (CRAC units) and dampers (with electric reheat and electric humidifiers locked out).
    b. Emergency Generator dampers and supply fan SF-1.
    c. The entire new portions of the ATC system related to this equipment.
2. Equipment not powered by Astand-by@ circuits shall default to their fail-safe positions.

F. Wall mounted thermostats and temperature and humidity 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. 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.

H. Power Line Filtering: Internal or external transient voltage and surge suppression for 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.

2.5 SPARE POINTS

A. Provide a minimum of 10% spare points or 8 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.

2.6 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.

C. Humidity Sensors: Bulk polymer sensing element.
1. Accuracy: 2 percent full range with linear output.
2. Room Sensor Range: 20 to 80 percent relative humidity.
3. Room Sensor Cover Construction: See below.

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.

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.

2.7 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 Pumps: Differential-pressure switch with pilot-duty rating and with adjustable pressure-differential range of 8 to 60 psig (55 to 414 kPa), piped across pump.

C. 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.

D. 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.

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.

2.8 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 "Common Motor Requirements for HVAC Equipment."
   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 with Edge Seals: 7 inch-lb/sq. ft. (86.8 kg-cm/sq. m) of damper.
      b. Opposed-Blade 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.
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.

2.9 DAMPERS

A. Manufacturers:
1. Ruskin; CD60 or CD50 dampers.
2. American Warming & Ventilating.
3. Arrow.
4. Greenheck.
5. Tamco (T.A. Morrison & Co., Inc.).

B. Description:
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. 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 are specified in Division 27, provided under this Section.

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. 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.

G. Install automatic dampers according to Division 23 Section "Air Duct Accessories."

H. Install damper motors on outside of duct in warm areas, not exposed to outdoor temperatures. Provide stand-off brackets of depth to meet or exceed specified thickness of duct insulation.

I. Install duct volume-control dampers according to Division 23 Sections specifying air ducts.

J. Install labels and nameplates to identify control components according to Division 23 Section "Identification for HVAC Piping and Equipment."

K. Install electronic and fiber-optic cables according to Division 27.

L. 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. Exhaust air dampers at generator - fail safe to fully closed.
   2. Intake and Recirculation air dampers at generator - fail safe to fully open.
   3. Supply air dampers at Air Conditioners - fail safe to fully closed.

M. 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 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 27.
   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 hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

G. Connect lead-lag controls to lock out the failed or non-selected motor, to prevent simultaneous operation.

H. Connect lead-lag controls so that only one motor can run in starter “hand” position.

I. 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.

3.4 FIELD QUALITY CONTROL

A. Coordinate with the requirements of Section 019000 - General Commissioning Requirements.

B. 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.

C. 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.

D. 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 temperature instruments and material and length of sensing elements.
5. 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.

E. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 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 milliampere 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. 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.
6. 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.
7. 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.
8. Provide diagnostic and test instruments for calibration and adjustment of system.
9. 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.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Mechanical instrumentation and controls. Refer to Division 01 Section "Demonstration and Training."

3.7 TRAINING

A. Training shall be by the ATC Subcontractor and shall utilize specified manuals and as-built documentation.

B. Operator training shall include 1 four-hour session encompassing:
1. Sequence of Operation review.
2. Selection of displays and reports.
3. Use of the specified functions.
4. Modifying setpoints.
5. Troubleshooting of sensors.
6. Owner questions/concerns.

C. Training session shall be conducted at project substantial completion.

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 Commissioning Agent and 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 COMPUTER ROOM AIR CONDITIONERS (CRAC-1A & B, CRAC-2A & B)

A. Space Temperature and Humidity Sensors: Wall-mounted, blank cover, without setpoint dial or thermometer.

B. The CRAC units are sized to be 100% redundant, so only one indoor unit operates at any time.

C. Dampers: 2-position supply dampers and actuators with auxiliary switches are provided under this Section.

D. The factory-furnished unit-mounted controllers control the indoor and outdoor units, and provide control of supply dampers provided under this Section. The Network Switch Assembly furnished with the CRAC units is wall-mounted and wired to interconnect the 2 CRAC unit microprocessors, enabling them to work together in lead/lag manner and to share some functions.

E. The Mechanical Subcontractor is responsible for CRAC factory-furnished controller setup and programming.

F. Lead/Lag Control:
1. The CRAC factory-mounted unit controls provide lead/lag control, based on unit runtime (to encourage even wear) and trouble status.
2. The lead status of the 2 units alternates at intervals recommended by the Owner.
3. If the lead CRAC unit is in trouble alarm mode, the lag unit is enabled and a trouble alarm is generated at the ATC system operator workstation.
4. If both CRAC units are in trouble alarm mode, a critical environmental alarm is generated at the ATC system operator workstation.
5. When one unit is enabled, the other unit is locked out to prevent simultaneous operation. An override at the ATC system operator workstation allows this lockout to be overridden, but in emergency generator mode only one unit is enabled.

G. Lead Unit Operation:
1. A relay furnished with the CRAC unit opens the 2-position damper.
2. When an auxiliary switch furnished with the damper proves the damper is nearing full open, the indoor fan starts and runs continuously.
3. An airflow proving switch prevents operations of some functions when there isn't sufficient supply airflow.
4. On a call for cooling, the compressors and condenser fans cycle.
5. On a call for heating, the electric heating coil cycles.
6. On a call for humidification, the electric humidifier cycles.
7. On a call for dehumidification, the compressors and condenser fan cycle to dehumidify, and the electric heating coil cycles to reheat as required.

H. Setpoints in the Manufacturer's Controller: Temperature range 65°F heating to 75°F cooling. Humidity range 35% to 55% RH. On the CRAC controller, these correlate to temperature setpoint of 70°F with sensitivity of ±5°F, and humidity setpoint of 45%RH with sensitivity of ±10%. These setpoints are within the range of recommendations issued by ASHRAE in 2008, and will reduce energy consumption relative to older-generation tight tolerances.

I. Emergency Power: Relays furnished in the CRAC unit lock out the electric humidifier and electric reheat coils when a signal from the generator indicates that the system is in emergency-

power mode. Dehumidification is locked out when the return temperature is so low that electric reheat would be required. Provide wiring as required.

J. Monitoring:
   1. ATC-system wall-mounted sensors monitor space temperature and humidity. Provide sensors in the locations indicated.
   2. Provide a set of input points in the Computer Room, for a future pair of temperature and humidity sensors which will be mounted in a cold aisle between computer racks. Provide wiring to a location above the ceiling over the computer racks, with enough length of wire to be able to run the wiring down between the racks. Program these points, and disable them until future installation of the sensors.
   3. ATC system monitors and displays complete CRAC-unit control functions thru the Modbus RS-485 interface modules furnished with the CRACs. Cabling and any necessary controllers to connect to the interface modules are furnished under this Section. Note that the interface modules have a maximum cabling length from the CRACs to the ATC-system connection.

K. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
   1. Space temperature and humidity at the ATC wall-mounted sensors.
   2. Space temperature and humidity at the CRAC unit integral sensors.
   3. Supply damper command, and position.
   4. Lead unit selection.
   5. Lead unit trouble and energizing of lag unit.
   6. Runtime for each unit (accumulative).
   7. Fan status.
   8. Cooling/heating/dehumidification/humidification modes status.
   9. Underfloor leak detector status.
   10. Dirty filter alarm.
   11. System trouble alarm.
   12. Inergen fire alarm status and unit shutdown interlock.
   13. Room temperature and humidity out of range at ATC wall-mounted sensors.
   14. Room temperature and humidity out of range at CRAC unit controls.

4.3 FIRE ALARM SYSTEM INTERFACE

A. Data Center CRAC Units: The units remain fully operation during an Inergen fire protection system alarm condition. The Inergen system will have adequate capacity to allow the fans to continue to run.

B. The room pressure relief through the roof vent cap or hood is accomplished by the opening of a backdraft or counterbalanced damper in the relief duct. No control of this damper is required.

C. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
   1. Inergen system trouble alarm.
   2. Inergen fire alarm status.

4.4 EMERGENCY GENERATOR INTERFACE

A. An emergency generator will be furnished under a separate Contract.

B. In emergency power mode, a start signal to the computer room air conditioners is furnished under Division 26.

C. Data Center Lead Computer Room Air Conditioner & Condenser (CRAC-1A&B, or CRAC-2A&B): Electric reheat, and electric humidifier are locked out on emergency power, by means of generator interface with relays furnished with the CRACs. Indoor and outdoor fans and cooling start and operate normally.

D. Operator Station Display: At a minimum, indicate the following on operator workstation display terminal:
   1. Generator signal to start the CRACs in emergency power mode.
   2. Generator signal to lock out the reheat and humidifier.

END OF SECTION 230900

SECTION 232113 – HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings For:
   1. Condenser and drycooler water piping system.
   2. Equipment drains and overflows.

B. Valves:
   1. Gate valves.
   2. Globe or angle valves.
   3. Ball valves.
   4. Butterfly valves.
   5. Check valves.

1.2 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Access Doors.

1.3 RELATED SECTIONS

A. Division 08 Section “Access Doors and Frames.”

B. Division 09 Section “Painting.”

C. Division 23 Section “Expansion Fittings and Loops for HVAC.”

D. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

E. Division 23 Section “Identification for HVAC Piping and Equipment.”

F. Division 23 Section “Vibration and Seismic Controls for HVAC Piping and Equipment.”

G. Division 23 Section “HVAC Piping Insulation.”

H. Division 23 Section “Hydronic Specialties.”

I. Division 23 Section “HVAC Water Treatment.”

1.4 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 D2310 - Machine-Made Reinforced Thermosetting Resin Pipe.

L. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

M. ASTM F2389 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

N. AWS A5.8 - Brazing Filler Metal.

O. AWS D1.1 - Structural Welding Code.

P. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications

Q. NSF/ANSI 14 – Plastic Piping System Components and Related Materials

1.5 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.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of valves.

1.7 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.

1.8 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.

C. Welders: Certify in accordance with ASME SEC 9. and AWS D1.1.

1.9 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.

1.10 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 CONDENSER WATER PIPING, ABOVE GROUND

A. Steel Pipe: ASTM A53, Schedule 40, black.
   1. Fittings: ASTM B16.3, malleable iron or ASTM A234, forged steel welding type.
   2. Joints: Threaded for pipe sizes 2" (50.8 mm) and smaller, or AWS D1.1 welded for pipe sizes 2 2" and larger.
   3. Grooved and Shouldered Pipe End Couplings: Not allowed.

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.

C. Pressure Rated Polypropylene Pipe: As specified in this Section.

2.2 EQUIPMENT DRAINS AND OVERFLOWS

A. Copper Tubing: ASTM B88, Type L, hard drawn.
   1. Fittings: ASME B16.18, cast brass, or ASME B16.22 solder wrought copper.
   2. Joints: Solder or braze.

2.3 PRESSURE-RATED POLYPROPYLENE PIPE

A. Manufacturer: Aquatherm, Inc. of Orem, UT. Climatherm faser-composite product line. No substitutions.

B. Standards:
   1. ASTM F2389-07 - Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems
   2. CSA B137.11 - Polypropylene (PP-R) Pipe and Fittings for Pressure Applications
   3. NSF/ANSI 14 – Plastic Piping System Components and Related Materials

C. Pipe Material: PP-R resin meeting the short-term properties and long-term strength requirements of ASTM F2389 or CSA B137.11. Pipe shall contain no rework or recycled materials except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. Pipe shall be made in a three layer extrusion process. Pipe shall contain a fiber layer (faser) to restrict thermal expansion.

D. Rated Pressure Requirements: ASTM F2389 or CSA B137.11.

E. Linear Expansion Coefficient: $(2.367 \cdot 10^{-4})$in./ft-°F (0.035 mm¶m-K).

F. Dimensions:
   1. SDR 11. Sizes 1/2” and 3/4” nominal (12.7 mm and 19.0 mm) shall be SDR 7.4.
   2. Product is furnished in metric sizes. Submit a chart of proposed equivalents to the Imperial (U.S.) sizes indicated on the Drawings. When piping on the Drawings is designed based on copper or steel, the flow characteristics of polypropylene relative to metal piping, including friction factor, corrosion, and mineral buildup, may be considered. Do not exceed the manufacturer’s recommended velocity limit of 8 fps (2.4 m/s).

G. Fittings:
   1. Heat-fusion welded, of the same material as the piping. Socket fusion for smaller sizes, and butt fusion for larger sizes, using electric heating irons. Outlet fusion using special curved fittings is acceptable for creating fittings directly into the side of the pipe. Electrofusion by running electrical current through special fittings is acceptable.
   2. Provide transition fittings to other piping materials, including transitions from metric to Imperial sizes.
   3. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by

the pipe and fittings manufacturer.

H. UV Light Exposure: Handle, store, and install piping to prevent exposure to UV light such as sunlight. For piping which may be installed where exposed to UV light for more than 10 days, provide a factory-applied UV-resistant coating.

I. Plenum Applications:
1. Where piping is indicated on the Drawings in air plenum locations, the pipe shall be pre-insulated or field insulated. When tested with standard un-insulated fittings per CAN/ULC-S102.2-03 or ASTM E84, the system consisting of wrapped pipe and bare fittings shall have a Flame Spread Classification of less than 25 and Smoke Development rating of less than 50.
2. Pre-insulated pipe shall be Aquatherm Advanced (wrapped and insulated).

J. Warranty: Manufacturer shall warrant pipe and fittings for 10 years to be free of defects in materials or workmanship. Warranty shall cover labor and material costs of repairing and/or replacing defective materials and repairing any incidental damage caused by failure of the piping system due to defects in materials or workmanship.

2.4 BRAZING MATERIALS - 15% Silver for copper, brass, and bronze

A. Manufacturers:
1. Harris (Product: Stay-Silv 15).
2. Lucas-Milhaupt (Product: Sil-Fos 15).
3. Wolverine (Product: Silvaloy 15).
4. No substitutions.

B. Nominal Composition: 5.0% phosphorus, 15.0% silver, 0.15% other elements (total), remainder copper. Cadmium-free.

C. Physical Properties:

1.	Color:	Yellow/Gray
2.	Solidus:	1190°F (643°C)
3.	Liquidus:	1480°F (802°C)
4.	Brazing Range:	1300 - 1500°F (704-816°C)
5.	Electrical Conductivity:	9.9% IACS
6.	Electrical Resistivity:	17.40 Microhm-cm

D. Specification Compliance:
1. ANSI/AWS A5.8, class BCuP-5
2. ASME SFA5.8, class BCuP-5
3. Optional:
   a. QQB 650C, class BCuP-5
   b. QQB 654A, class BCuP-5
   c. QQB 654, class BCuP-5

E. Flux:
1. Harris (Stay-Silv For copper-to-brass joints. No flux required for copper-to-copper joints).

2.5 BRAZING MATERIALS - 35% Silver for brazing to ferrous metals (steel)

A. Manufacturers:
   1. Harris (Product: Safety-Silv 35).
   2. Lucas-Milhaupt (Product: Braze 351).
   3. Wolverine (Product: Silvaloy A-35).
   4. No substitutions.

B. Nominal Composition: 35.0% silver, 33% Zinc, 0.15% other elements (total), remainder copper. Cadmium-free.

C. Physical Properties:

1.	Color:	Yellow/Gray
2.	Solidus:	1250°F (677°C)
3.	Liquidus:	1410°F (732°C)
4.	Electrical Conductivity:	19.8% IACS
5.	Electrical Resistivity:	8.2 Microhm-cm

D. Specification Compliance:
   1. ANSI/AWS A5.8, class BAg-5
   2. ASME SFA5.8, class BCuP-5

E. Flux:
   1. Harris (Stay-Silv white flux, or where heating cycles are extended, Stay-Silv black flux).

2.6 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.

2.7 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. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.8 VALVES

A. Manufacturers:
1. Nibco.
2. Apollo.
3. Hammond.
4. Watts.
5. 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.
3. Polypropylene Valves for Polypropylene Piping: May be used instead of standard ball valves.
   a. Manufacturer: Aquatherm, Greenpipe product line, no substitutions.
   b. Material: Polypropylene body and handle.
   c. Up to and including 2-1/2 inch (75 mm) size: Integral union ends, tee handle.
   d. Over 2-1/2 inches: Flange ring ends, lever handle.

E. Butterfly Valves:
1. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer or lug ends, extended neck.
2. Disc: Aluminum bronze or chrome plated ductile iron.
3. Operator: 10 position lever handle for shut-off service, infinite position lever handle with memory stop for throttling service, handwheel and gear drive for sizes 8" (203 mm) and larger.
4. Pressure rating shall be 150 PSI at 225EF (1034 kPa at 107EC).

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.

H. Valves located indoors used in condenser and drycooler water systems that can operate at fluid temperatures below room temperature shall be furnished with factory installed insulated handles and stems, equal to Nibco NIB-SEAL. For valves that exceed maximum available factory pre-insulated valve sizes, provide valves with extended stems to allow for continuous field installed vapor barrier insulation to prevent condensation. Aquatherm polypropylene-body ball valves may have standard stems, due to the inherent insulating properties of the polypropylene material.

2.9 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, and condenser water 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. Refer to Division 23 Section “Expansion Fittings and Loops for HVAC.”

H. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Division 08 Section "Access Doors and Frames."

I. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

J. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Division 09 Section "Painting."

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. Polypropylene Pipe:
   1. Fusion Welding of Joints:
      a. Install fittings and joints using socket-fusion, elecrofusion, or butt-fusion as applicable for the fitting or joint type. Make fusion-weld joints in accordance with the pipe and fitting manufacturer's specifications and product standards.
      b. Fusion-weld tooling, welding machines, and electrofusion devices shall be as specified by the pipe and fittings manufacturer.
      c. Prior to joining, prepare the pipe and fittings in accordance with ASTM F2389 and the manufacturer's specifications.
      d. For socket and other insertion-type fusion, mark the piping at its recommended insertion depth prior to heating the pipe and fitting.
      e. Joint preparation, setting and alignment, fusion process, cooling times and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.
   2. Fire stopping shall be provided to both be compatible with the piping and meet the requirements of ASTM E814 or ULC S115, "Fire Tests of Through-Penetration Firestops". Pipe insulations or fire resistive coating shall be removed where the pipe passes through a firestop and, if required by the firestop manufacturer, for 3 inches (75 mm) beyond the firestop outside of the fire barrier.
   3. In systems with pumps in excess of 7.5 HP motor size, protect piping from the excessive heat that may be generated when the pump is operated at shut-off conditions. The protection method shall be a temperature relief valve or comparable level of protection, set to a maximum temperature of 185°F (85°C).

N. Use unions and flanges downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to control valves, equipment or other apparatus.

O. Use non-conducting dielectric connections whenever jointing dissimilar metals.

P. Valve Type Selection:
   1. Use gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers.
   2. Use globe, ball or butterfly valves for throttling, bypass, or manual flow control services.

3. Use N.R.S. Gate Valves for general shut-off service in hydronic system piping 2-1/2" (63.5 mm) and larger.
4. Use Butterfly Valves in hydronic system piping for general shut-off service at equipment connections 2" (50.8 mm) and larger.

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 hydronic system piping 2" (50.8 mm) and smaller.
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 Agarden 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, AWeldolet@ or AThreadolet@ 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 that 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 and cooling 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.

END OF SECTION 232113

SECTION 232118 – HYDRONIC SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Air vents.

B. Strainers.

C. Flow indicators, controls, meters.

D. Combination Valve Assemblies.

E. Relief valves.

F. Glycol specialties.

1.2 RELATED SECTIONS

A. Division 23 Section “Meters and Gauges for HVAC Piping”: Test Ports.

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 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. Taco.
   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. Taco.
   2. Brass with hydroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.2 STRAINERS

A. Manufacturers:
   1. Sarco.
   2. Armstrong.
   3. Barnes and Jones.
   4. Bell & Gossett.
   5. Muesco.
   6. Sarco.

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.

2.3 BALANCING VALVES AND COMBINATION BALANCING/SHUT-OFF VALVES.

A. Manufacturers:
   1. Bell & Gossett.
   2. Armstrong.
   3. Flow Design, Inc.
   4. Gerand.
   5. Mepco.
   6. Nexus Valve.
   7. Taco.
   8. Tour and Andersson.
   9. Watts.
   10. 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.
   2. Variable-Orifice Manual Balancing Valve: Cast iron or bronze, globe style, balance valve with handwheel with vernier type ring setting and memory stop, readout valves equipped with integral check valves and gasketed caps. Readout valves measure the pressure differential across the variable opening between valve plug and valve seat. Valve shall be

designed for positive shut-off. Drain valve may be furnished with this valve, and if positioned properly may be substituted for the separate drain valve indicated.

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 "HVAC Piping Insulation."

2.4 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.

2.5 RELIEF VALVES

A. Manufacturers:
1. Bell & Gossett.
2. Cash Acme.
3. Spence.
4. Taco.
5. Watts.

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 or below equipment and piping rated pressure.

2.6 GLYCOL SYSTEM

A. Mixing Tank: Steel or plastic drum with fittings suitable for filling and hand pump for charging, rubber hose for connection of hand pump to system.

B. Air Pressure Reducing Station: Pressure reducing valve with shut-off valves, strainer, check valve and needle valve bypass.

C. Glycol Solution:
1. Manufacturers:
   a. Dow Chemical Co.
   b. No Substitutions.

2. Inhibited propylene glycol and water solution mixed 50 percent glycol - 50 percent water, suitable for operating temperatures from -40 degrees F (-40 degrees C) to 250 degrees F (121 degrees C).
3. Water used in solution shall conform to glycol manufacturer-s requirements. Water shall have low levels (less than 25 ppm) of chloride and sulfate, and less than 50 ppm of hard water ions (Ca++, Mg++). Distilled or deionized water is recommended. If good quality water is unavailable, purchase pre-diluted solutions of fluid from the fluid manufacturer or from the distributor.
4. Provide containers of undiluted inhibited glycol as required to compensate for any water left in the system after initial flushing, testing, and draining.

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 valved drain and hose connection on strainer blow down connection.

F. Provide pump suction fitting on suction side of base mounted centrifugal pumps. Remove fine-mesh temporary startup strainers after flushing and cleaning systems; hang the startup strainer at the pump to demonstrate to the Engineer that it was removed. If strainer-s removable cover is insulated (systems with fluid below surrounding temperature) the insulation shall be removable and reusable.

G. Provide balancing valves on water outlet from terminal 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. Clean and flush glycol system before adding glycol solution. Refer to Division 23 Section "HVAC Water Treatment."

O. Feed glycol solution to system through make-up line with pressure regulator, venting system high points. Set fill pressure as recommended by equipment manufacturer.

P. Perform tests determining strength of glycol and water solution and submit written test results.

Q. Standard details for heating and cooling 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.

END OF SECTION 232118

SECTION 232300 – REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and Liquid Indicators, and Filter-Driers.

D. Valves.

E. Strainers.

1.2 RELATED SECTIONS

A. Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

B. Division 23 Section “HVAC Piping Insulation.”

C. Division 23 Section “Computer-Room Air-Conditioners.”

D. Division 26 “Electrical.”

1.3 REFERENCES

A. ARI 495 - Refrigerant Liquid Receivers.

B. ARI 710 - Liquid Line Dryers.

C. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers

D. ARI 750 - Thermostatic Refrigerant Expansion Valves.

E. ARI 760 - Solenoid Valves for Use With Volatile Refrigerants.

F. ASHRAE 15 - Safety Code for Mechanical Refrigeration.

G. ASHRAE 34 - Number Designation of Refrigerants.

H. ASME - Boiler and Pressure Vessel Codes, SEC 9 - Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

J. ASME B16.26 - Cast Copper Alloy Fittings For Flared Copper Tubes.

K. ASME B31.5 - Refrigeration Piping.

L. ASME B31.9 - Building Services Piping.

M. ASME SEC 8D - Boilers and Pressure Vessels Code, Rules for Construction of Pressure Vessels.

N. ASTM A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.

O. ASTM B88 - Seamless Copper Water Tube.

P. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

Q. AWS A5.8 - Brazing Filler Metal.

R. AWS D1.1 - Structural Welding Code, Steel.

S. UL 429 - Electrically Operated Valves.

1.4 SYSTEM DESCRIPTION

A. 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, unions, and couplings for servicing are consistently provided.

B. Liquid Indicators:
1. Use line size liquid indicators in main liquid line leaving condenser.
2. If receiver is provided, install in liquid line leaving receiver.
3. Use line size on leaving side of liquid solenoid valves.

C. Valves:
1. Use service valves on suction and discharge of compressors.
2. Use gauge taps at compressor inlet and outlet.
3. Use gauge taps at hot gas bypass regulators and at filters and filter driers, inlet and outlet.
4. Use check valves on compressor discharge.
5. Use check valves on condenser liquid lines on multiple condenser systems.

D. Refrigerant Charging (Packed Angle) Valve: Use in liquid line between receiver shut-off valve and expansion valve.

E. Strainers:
1. Use line size strainer upstream of each automatic valve.
2. Where multiple expansion valves with integral strainers are used, use single main liquid line strainer.
3. On steel piping systems, use strainer in suction line.
4. Use shut-off valve on each side of strainer.

F. Pressure Relief Valves: Use on ASME receivers and on compressors converted to higher pressure refrigerant. Pipe field-installed valves and valves furnished with equipment to outdoors as required by ASHRAE Standard 15 and where directed.

G. Permanent Filter-Driers:
1. Use in low temperature systems.

2. Use in systems utilizing hermetic compressors.
3. Use filter-driers for each solenoid valve.

H. Replaceable Cartridge Filter-Driers:
1. Use vertically in liquid line adjacent to receivers.
2. Use with filter elements in suction line. Provide temporary wax removal filter-drier core in low temperature systems and systems where motor failure has occurred.
3. Use filter-driers for each solenoid valve.

I. Solenoid Valves:
1. Use in liquid line of systems operating with single pump-out or pump-down compressor control.
2. Use in liquid line of single or multiple evaporator systems.
3. Use in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

J. Receivers:
1. Use on systems 5 tons (18 kW) and larger, sized to accommodate pump down charge.
2. Use on systems with long piping runs.

K. Flexible Connectors: Utilize at or near compressors where piping configuration does not absorb vibration.

1.5 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

C. Product Data: Provide general assembly of specialties, including manufacturer-s catalog information. Provide manufacturer-s catalog data including load capacity.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Submit welders- certifications of compliance with AWS D1.1., and their assigned identification letters, numbers or symbols.

1.6 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record exact locations of equipment and refrigeration accessories on record drawings.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.8 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section with minimum three (3) years documented experience.

B. Design piping system under direct supervision of a Professional Engineer experienced in design of this work and licensed at the place where the Project is located.

1.9 REGULATORY REQUIREMENTS

A. Conform to ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Conform to ASME SEC 9 and applicable state labor regulations.

C. Welders Certification: In accordance with AWS D1.1. and state and local requirements.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

E. Refrigerant Safety: Conform with ASHRAE 15, state and local codes and manufacturer=s requirements for safe handling to avoid exposure to workers or to occupants.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 01 Section “Product Requirements.”

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

D. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.11 MAINTENANCE MATERIALS

A. Provide maintenance materials under provisions of Division 01 Section “Closeout Procedures.”

B. Provide two refrigeration oil test kits, each containing everything required to conduct one test.

C. Provide two filter-dryer cartridges of each type.

PART 2 - PRODUCTS

2.1 PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn, degreased, nitrogen charged and sealed. Annealed (soft) tubing may be used only for underfloor or below grade runs or for short (6 feet or less) above-grade connections to valves and equipment.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints:
      a. Braze, 15% silver for copper, brass, and bronze.
      b. Braze, 35% silver, for brazing to ferrous metals (steel).
      c. Solder (for use only at equipment and valve connections where required by the equipment manufacturer).
      d. Other: If a valve or equipment manufacturer recommends a joint material other than those specified, submit it for approval.
      e. Flux: Use as recommended by alloy manufacturer. Should not be needed for copper-to-copper brazed joints.

B. Copper Tubing to 7/8 inch (22 mm) OD: ASTM B88, Type K, annealed.
   1. Fittings: ASME B16.26 cast copper.
   2. Joints: Flared.

C. Pipe Sleeves: Provide galvanized steel pipe sleeves for penetrations of walls, floors and roofs. Sleeves through non-fire-rated interior partitions shall be of G-90 coated galvanized steel sheet not less than 0.0217 inches (0.55 mm) thick (26 gauge).

D. Watertight Pipe Sleeves:
   1. Manufacturer: Thunderline Link-Seal.
   2. Sleeve: Segmented rubber seal with stainless steel tightening bolts. Provide suitable sleeve or core-drilled hole.

2.2 BRAZING MATERIALS - 15% Silver

A. Manufacturers:
   1. Harris (Product: Stay-Silv 15).
   2. Lucas-Milhaupt (Product: Sil-Fos 15).
   3. Wolverine (Product: Silvaloy 15).
   4. No substitutions.

B. Nominal Composition: 5.0% phosphorus, 15.0% silver, 0.15% other elements (total), remainder copper. Cadmium-free.

C. Physical Properties:

1.	Color:	Yellow/Gray
2.	Solidus:	1190°F (643°C)
3.	Liquidus:	1480°F (802°C)
4.	Brazing Range:	1300 - 1500°F (704-816°C)
5.	Electrical Conductivity:	9.9% IACS
6.	Electrical Resistivity:	17.40 Microhm-cm

D. Specification Compliance:
   1. ANSI/AWS A5.8, class BCuP-5
   2. ASME SFA5.8, class BCuP-5
   3. Optional:
      a. QQB 650C, class BCuP-5
      b. QQB 654A, class BCuP-5
      c. QQB 654, class BCuP-5

E. Flux:
   1. Harris (Stay-Silv For copper-to-brass joints. No flux required for copper-to-copper joints).

2.3 BRAZING MATERIALS - 35% Silver

A. Manufacturers:
   1. Harris (Product: Safety-Silv 35).
   2. Lucas-Milhaupt (Product: Braze 351).
   3. Wolverine (Product: Silvaloy A-35).
   4. No substitutions.

B. Nominal Composition: 35.0% silver, 33% Zinc, 0.15% other elements (total), remainder copper. Cadmium-free.

C. Physical Properties:

1.	Color:	Yellow/Gray
2.	Solidus:	1250°F (677°C)
3.	Liquidus:	1410°F (732°C)
4.	Electrical Conductivity:	19.8% IACS
5.	Electrical Resistivity:	8.2 Microhm-cm

D. Specification Compliance:
   1. ANSI/AWS A5.8, class BAg-5
   2. ASME SFA5.8, class BCuP-5

E. Flux:
   1. Harris (Stay-Silv white flux, or where heating cycles are extended, Stay-Silv black flux).

2.4 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.

2.5 REFRIGERANTS AND LUBRICANTS

A. Refrigerant: ASHRAE 34;
1. R-32: Difluoromethane. Component of blends.
2. R-125: Pentafluoroethane. Component of blends.
3. R-134a: Tetrafluoroethane. Suitable for new equipment and retrofits.
4. R-407c: Blend of R-32/125/134a. Suitable for retrofits.
5. R-410a: Blend of R-32/125. Suitable for new equipment.

B. Oils and Other Lubricants: Provide as required by the refrigerant manufacturer and the equipment manufacturer(s).

2.6 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
1. Sporlan Valve Co, Model ASee-All@.
2. Henry Valve Co.
3. Mueller.

B. Indicators: Double port type, UL listed, with steel body, flared or copper plated solder ends, leak proof fused sight glass, replaceable color coded paper moisture indicator and plastic cap; for maximum working pressure of 500 psig (3450 kPa) for connection sizes 1-1/8 inch (29 mm) O.D. and smaller, 430 psig (2960 kPa) for sizes 1-3/8 inch (35 mm) O.D. and larger, and maximum temperature of 200EF (93EC). Synthetic gaskets are not allowed.

2.7 VALVES

A. Diaphragm Packless Valves:
1. Manufacturers:
a. Henry Valve Co.
b. Mueller.
c. Superior.

2. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 275EF (135EC).

B. Packed Angle Valves:
1. Manufacturers:
a. Henry Valve Co.
b. Mueller.
c. Superior.
2. Forged brass (or brass and copper), forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 275EF (135EC).

C. Ball Valves:
1. Manufacturers:
a. Henry Valve Co.
b. Mueller.
c. Superior.
2. Two piece forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 325EF (163EC).

D. Service Valves:
1. Manufacturers:
a. Henry Valve Co.
b. Mueller.
c. Superior.
2. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psig (3450 kPa).

2.8 STRAINERS

A. Straight Line or Angle Line Type:
1. Manufacturers:
a. Henry Valve Co.
b. Sporlan.
c. Superior.
2. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psig (2960 kPa).

B. Straight Line, Non-Cleanable Type:
1. Manufacturers:
a. Henry Valve Co.
b. Mueller.
2. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of 430 psig (2960 kPa).

C. Screens: 80 mesh (0.007 in. (0.18 mm) square openings) in most uses, 60 mesh (0.010 in. (0.25

mm) square openings) in line sizes above 1-1/8 inch (29 mm), and 40 mesh (0.015 in. (0.38 mm) square openings) for use in suction lines.

2.9 CHECK VALVES

A. Globe Type:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.
   2. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 300EF (149EC).

B. Straight Through Type:
   1. Manufacturers:
      a. Henry Valve Co.
      b. Mueller.
      c. Superior.

C. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psig (3450 kPa) and maximum temperature of 250EF (121EC).

2.10 PRESSURE RELIEF VALVES

A. Manufacturers:
   1. Henry Valve Co.
   2. Mueller.
   3. Superior.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard setting; selected to ASHRAE 15.

2.11 FILTER-DRIERS

A. Replaceable Cartridge Angle Type:
   1. Manufacturers: Sporlan, Model CW Catch-All.
   2. Shell: ARI 710, UL listed, steel with epoxy paint finish, copper sweat fittings, removable cap with zinc-plated fasteners, for maximum working pressure of 500 psig (3450 kPa), size as recommended by manufacturer.
   3. Suction Filter Cartridge: Pleated media with integral end rings, stainless steel support, ARI 730 rating for capacity of the equipment served.
   4. Filter/Dryer Cartridge: Pleated media with solid core molecular sieve with activated alumina, ARI 730 rating for capacity of the equipment served.
   5. Wax Removal Cartridge: Molded bonded core of activated charcoal with integral gaskets, with filter surface area, desiccant volume and ARI 710 moisture rating as recommended by the manufacturer based on line size and refrigeration system horsepower (kW).

B. Permanent Straight Through Type:
   1. Manufacturers: Sporlan, Model CW Catch-All.

   2. ARI 710, UL listed, steel shell with copper plated steel sweat or flare fittings, molded molecular sieve/activated alumina desiccant filter core, for maximum working pressure of 500 psig (3450 kPa).
   3. Rating: ARI 730 flow capacity of the equipment served.

2.12 SOLENOID VALVES

A. Manufacturers:
   1. Sporlan.
   2. Henry Valve Co.
   3. Parker Hannifin.

B. Valve: ARI 760, pilot operated, brass or steel body and internal parts, teflon seat, stainless steel stem and plunger assembly, with flared, solder, or threaded ends; for maximum working pressure of 500 psig (3450 kPa). Stem shall have a knife-edge joint to the body and shall permit manual operation in case of coil failure.

C. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

D. Electrical Characteristics: 10 to 15 watts, voltage compatible with control system, single phase, 60 Hz.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers:
   1. Metraflex.
   2. Mason Industries.
   3. Keflex.

B. Corrugated bronze hose with single layer of exterior braiding, minimum 9 inches (230 mm) long with copper tube ends; for maximum working pressure 500 psig (3450 kPa).

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel or perpendicular to building structure, and maintain gradient.

C. Install annealed piping free of kinks, and with bends only as necessary.

D. Install piping to conserve building space and not interfere with use of space.

E. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.

H. Provide sleeves, sized to fit outside the pipe insulation with at least 1/4" clearance, at penetrations of building assemblies. Interrupt insulation where required by fire ratings. Extend floor sleeves to at least one inch above finished floor and seal watertight. For below-grade penetrations and where indicated, provide watertight link-seal pipe seals. Secure sleeves in place, and caulk, grout or firestop into the building assembly. Provide split chrome or painted escutcheons where exposed to occupancy.

I. Provide clearance for installation of insulation and access to valves and fittings.

J. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Division 08 Section "Access Doors and Frames."

K. Flood piping system with nitrogen when brazing.

L. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

M. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Division 09 Section "Painting."

N. Insulate piping and equipment; refer to Division 23 Section "HVAC Piping Insulation and HVAC Equipment Insulation."

O. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

P. Provide liquid line replaceable cartridge (unless sealed type is indicated) filter-driers, with isolation valves and valved bypass. On low temperature systems, or after a hermetic motor burnout, provide wax removal cores. Provide upstream and downstream pressure-testing access valves.

Q. Provide suction line replaceable cartridge filters, with isolation valves and valved bypass. Provide upstream and downstream pressure testing access valves. On low temperature systems, or after a hermetic motor burnout, provide temporary wax removal cores. After cleanup of the system,

replace cores with filter elements for lower pressure drop.

R. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

S. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

T. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

U. Fully charge completed system with refrigerant after testing.

V. Provide electrical connection to solenoid valves. Refer to Division 26.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01 Section "Quality Requirements."

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psig (1470 kPa). Perform final tests at 27 inches (92 kPa) vacuum and 200 psig (1470) kPa) using electronic leak detector. Test to no leakage.

D. Evacuate the system as required by Codes and by equipment manufacturer, including a vacuum test at 0.02 inches of mercury (500 microns). The system shall be valved off and tested for 2 hours with a pressure rise of no more than 0.002 inches of mercury (50 microns).

3.4 SYSTEM STARTUP

A. Lubricate motors and other moving parts as necessary before operating them.

B. Charge the system with liquid refrigerant into the low pressure side of the system, where the liquid will evaporate. Expel air from the system. Operate the compressor, condenser, water cooling pumps and evaporator fans during charging. Monitor compressor discharge pressure. Monitor oil levels for a period of 24 hours.

C. Coordinate control setpoints and wiring prior to startup.

D. Change suction filter elements if the pressure drop exceeds 1 Psi after the initial 24 hours of operation. Change suction wax removal cores to filter elements after system cleanup.

E. Adjust expansion valve superheat using a thermistor or thermocouple temperature sensor at the bulb location and a pressure gauge at the external equalizer line (or the compressor). Adjust under full system load, and again when the system stabilizes.

F. Check the system again after seven full days of operation.

G. Periodically clean strainers until no more accumulation occurs.

END OF SECTION 232300

SECTION 232500 – HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleaning of piping systems.

B. Chemical feeder equipment.

C. Chemical treatment.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code.

1.3 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.

1.4 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.

1.5 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.

1.6 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.

1.7 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.

1.8 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.

B. Closed System Treatment (Water):
1. Sequestering agent to reduce deposits and adjust pH; polyphosphate.
2. Corrosion inhibitors; liquid boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
3. Conductivity enhancers; phosphates or phosphonates.

2.3 BY-PASS (POT) FEEDER

A. Manufacturers:
1. Neptune Chemical Pump Co., Model DBF-5HP.
2. Griswold Filtration, Model CBF-5GE.

B. 5.0 gal (18.9 L), with quick opening cap, for working pressure of 200 psig (1370 kPa) at 200EF (93 C), fittings as required for piping configuration indicated on the Drawings, minimum of 3/4-in. FPT inlet, outlet, and bottom drain.

C. Plug any unused openings. If a fill funnel is provided, provide a lockable ball valve to prevent tampering.

D. Install above the floor with legs or pedestal. For feeders which don=t have integral legs or pedestal, provide additional support or concrete housekeeping pad.

2.4 TEST EQUIPMENT

A. Provide white enamel test cabinet with local and fluorescent light, capable of accommodating 4 - 10 ml zeroing titrating burettes and associated reagents.

B. Provide the Following Test Kits:
1. Alkalinity titration test kit.
2. Chloride titration test kit.
3. Sulphite titration test kit.
4. Total hardness titration test kit.
5. Low phosphate test kit.
6. Conductivity bridge, range 0 - 10,000 microhms.
7. Creosol red pH slide complete with reagent.
8. Portable electronic conductivity meter.
9. High nitrite test kit.

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 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 160EF (71EC) and maintain for 12 hours minimum.
   2. Remove heat and circulate to 100EF (37.8EC) 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. Chilled, Condenser, and Drycooler Water Systems:
   1. Circulate for 48 hours, then drain systems as quickly as possible.
   2. Refill with clean water, circulate for 24 hours, then drain.
   3. Refill with clean water and repeat until system cleaner is removed.

D. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.

E. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

F. Remove, clean, and replace strainer screens.

G. 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.

3.4 CLOSED SYSTEM TREATMENT

A. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.

B. Introduce closed system treatment through bypass feeder when required or indicated by test.

C. If a bypass feeder is not recommended by the equipment manufacturer and not required by the Contractor, provide fill and drain fittings with ball valves and hose-threaded ends with cap and chain.

END OF SECTION 232500

SECTION 233013 – HVAC AIR DUCT CLEANING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. 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 ductwork distribution system shall be cleaned in accordance with this specification section. 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.

B. Air duct cleaning to include site preparation, source removal of dirt and debris, chemical surface treatment, duct openings, sealing and repair of duct insulation.

1.2 QUALITY ASSURANCE

A. The publications listed below form a part of this specification to the extent referenced.

B. The publications are referred to in the text by the basic designation only.

C. NADCA Standard 1992-01, Mechanical Cleaning of Non-Porous Air Conveyance System Components.

D. SMACNA Standards, HVAC Duct Construction Standards - Metal and Flexible (HVACDCS).

1.3 AIR DUCT CLEANING CONTRACTOR

A. Obtain the services of a qualified HVAC system cleaning subcontractor to perform the air system cleaning as specified herein. Prior to commencing work under this section of the specifications, the testing organization shall have been approved by the Engineer. The criteria for determining qualifications shall be recent experience with similar projects done in accordance with National Air Duct Cleaners Association (NADCA) Standard 1992-01.

1.4 SUBMITTALS

A. Submit experience list of similar projects.

B. Submit cleaning methodologies and material safety data sheets (MSDS) for chemicals to be used.

PART 2 - PRODUCTS

2.1 APPROVED DUCT CLEANING AGENCIES

A. Air Duct Klean, a division of Kitchen Klean, Inc. - Tel # 800-736-4484

B. Maine Environmental Cleaning, a division of Mechanical Services, Inc. - Tel # 800-675-0229

C. Cochrane Ventilation, Inc. - Tel # 800-974-9055

D. Haley-s Metal Shop, Inc. - Tel # 207-284-8571

E. Steamatic - Tel # 207-657-3088

F. Portland Diversified Services - Tel # 800-639-3901

2.2 PROCEDURES FOR AIR DUCT CLEANING

A. Perform work in accordance with NADCA Standard 1992-01.

B. Supply materials for cleaning, repairing and inspection work including HEPA filtered collection systems, rotary brushes, air lances, mechanical agitators, fiber optic borescopes, vacuums, or other equipment and materials necessary to perform work specified. Furnish materials and equipment that are of a reputable manufacturer. Submit Material Safety Data Sheets for chemicals utilized in this project prior to product usage.

C. Access points shall be constructed of metal or plastic. Points shall be installed in a hole that is a minimum of 1 inch in diameter. Access points shall be reusable by maintenance staff. If external insulation is removed during the installation process, repair the open edges with a similar color repair tape (as best as possible).

D. Access doors shall consist of 3 layers of precision stamped 0.030-inch (23 gauge) (0.78 mm) electro-galvanized zinc-plated steel. The inside door shall consist of two layers of metal which are spot-welded together at the rim, encapsulating high density fiberglass insulation - UL classified FHC 25/50. The inside surface shall be smooth to reduce friction. The gasket which seals the door from the inside to the duct shall consist of a closed cell neoprane gasket which is UL 94HF 1 listed with a service temperature of (ASTM D-746) 70E to 220EF (21E to 104EC). The gasket shall be permanently bonded to the inside of the door to eliminate leakage. Conical springs shall be installed over the bolts, between the inner and outer door, to facilitate opening. Access shall be accomplished by use of high impact black phenolic molded knobs that have threaded brass inserts to eliminate thread stripping. Knobs shall be easy to turn by hand without wrenches. Door shall be tested to 20 in.WG (4.9 kPa) with no leakage noted. The installed access door will be a permanent reusable access system that can be utilized for further inspections and/or repair.

E. Clean outdoor air plenums thoroughly. Vacuum or scrape inlet louvers, bird screens, dampers, turning vanes, moisture deflectors and other irregular surfaces, if necessary.

F. Vacuum the interior surfaces of the mixing chamber, removing gross debris. Sanitize the plenum, drains, and dampers with an EPA registered sanitizing agent.

G. Remove filters from the rack and prepare the area for cleaning. If filters are to be reused, clean and store in a dry area. Scrape debris from the filter rack area. Vacuum clean and/or pressure wash the filter rack system (ensure proper drainage is available before cleaning). Sanitize the filter rack system.

H. Remove standing water from the condensate pans or base of the plenum. Clear the drains associated with each pan, ensuring proper operation before cleaning. If fins are bent prior to cleaning, straighten fins utilizing a coil combing system after the cleaning process. High-pressure-water clean the coil section. First apply a biodegradable cleaning solution to penetrate into the coil section (follow manufacturer=s guidelines). Repeat process on the other side of the coil section. Rinse each side. Continue process until clear water can penetrate coil section on entire coil face. After cleaning, sanitize coil section with an approved biocide-utilizing atomizing system. Report existing damage to the coil section or improper drainage in writing to the Architect.

I. Vacuum clean the fan housing and motors to remove debris. Hand scrape fan impellers and remove loose debris from the internal surfaces of the fan housing. Take precautions not to damage the impellers, alter blade shape or weight, or affect impeller balance.

J. Vacuum the internal surfaces of the plenums associated with the air handler. Remove gross debris and other debris or excess equipment that may be present. In severe cases, the internal plenum surface may be high-pressure-water cleaned to remove grease, dirt, and debris. After interior surfaces and equipment are cleaned, sanitize the unit with an approved sanitizer utilizing an atomizing system.

PART 3 - EXECUTION

3.1 DUCTWORK CLEANING PROCESS

A. Equipment used shall be portable and sized to enter these areas. Coordinate electrical requirements through the Owner=s electrical or maintenance department, as appropriate. Modifications to accommodate electrical requirements will be at the Contractor=s expense.

B. Address each main duct section by first securing debris collection equipment to diffuser branch ducts or to an isolated section of main trunk ductwork.

C. Collectors shall be fan powered, high velocity dust and particle collection systems which will be utilized in areas where debris is being removed from the system. Equip collection systems with HEPA filtration (99.97% collection efficiency for 0.3 micron size). The collection systems shall be self-contained, with appropriate components to adequately prevent dirt and debris loosened from upstream duct mains and branches during cleaning operations from entering the diffuser plenums by capturing this debris within the collection device. The components of the collector that connect the base collection unit to the duct or diffuser plenum shall be air-tight and reusable from area to area.

D. Agitate the loose debris on the interior surfaces to introduce the debris into the air flow produced and controlled by the collection systems. Collection systems shall be able to produce a minimum of 0.42 in.WG (104 Pa) in the targeted section of duct to be cleaned. Debris shall travel through the ductwork to the point of collection.

E. Ductwork shall be cleaned by inserting air powered brush systems, air powered extended whip sections, electric rotary brush systems, skipper balls, or air sweeps through the installed access. Utilize equipment that will best contact surfaces of the duct regardless of shape or size.

F. Where duct is large enough and able to support the weight of a worker, hand tools and vacuums may be used. Install collection equipment in the section of duct to be cleaned by hand as a precautionary measure to catch any residual debris.

G. Whenever the grilles, registers, or diffusers are removable, they shall be removed, washed, rinsed, dried, and then replaced. If for any reason they are not removable, they shall be vacuumed in place. Contractor is not responsible for existing improperly installed grilles, registers, and diffusers; for example, grilles, registers, or diffusers screwed directly into porous ceiling tiles. Whenever possible, reinstall grilles, registers, and diffusers that were originally improperly installed to the best of the Contractor-s ability in a timely manner. Report inability to reinstall grilles, registers, and diffusers in a proper manner in writing to the Architect.

H. Perform sanitizing of the air distribution system as required using an air sprayer or fogging device to cover the interior surfaces of the ductwork. Make certain that surfaces are kept wet for at least 10 minutes. Sanitizing fluid shall be registered with the Environmental Protection Agency. Sanitizing shall be accomplished through installed access doors and access points.

I. Perform duct cleaning and sanitizing only at a time when the targeted air distribution systems can be shut down and the facility cleared of occupants. Schedule the duct cleaning for an appropriate time. Note: AOccupants@ does not include maintenance or supervisory personnel who take proper precautions.

J. Replace, at no additional cost to the Owner, any ceiling tiles or gridwork that is/are damaged during the ductwork cleaning process.

K. De-activate and re-activate duct smoke detectors during the duct cleaning process. Coordinate with and receive approval from the local Fire Department and/or local Code Enforcement Officials prior to the de-activation and re-activation of smoke detectors.

3.2 PROJECT ASSESSMENT

A. Provide inspection access to the Architect any time during or immediately after the cleaning of the air delivery system or systems. Inspection shall be visual in nature by means of installed access doors and points with the benefit of a fiber optic borescope where necessary. Meet the guidelines set down in the NADCA Standard 1992-01 for Mechanical Cleaning of Non-Porous Air Conveyance System components.

B. Perform the NADCA vacuum test and submit report for approval.

C. Show exact locations of access doors installed as part of the cleaning process on the Record Drawings.

END OF SECTION 233013

SECTION 233113 – METAL DUCTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal Ductwork.

B. Nonmetal Ductwork.

C. Casing and Plenums.

1.2 RELATED SECTIONS

A. Division 23 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.”

D. Division 23 Section “HVAC Air Duct Cleaning.”

E. Division 23 Section “Air Duct Accessories.”

F. Division 23 Section “Air Outlets and Inlets.”

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. AWS D9.1 - Welding of Sheet Metal.

K. NBS PS 15 - Voluntary Product Standard for Custom Contact-Molded Reinforced-Polyester Chemical Resistant Process Equipment.

L. NFPA 90A - Installation of Air Conditioning and Ventilating Systems.

M. NFPA 90B - Installation of Warm Air Heating and Air Conditioning Systems.

N. SMACNA - HVAC Air Duct Leakage Test Manual.

O. SMACNA - HVAC Duct Construction Standards - Metal and Flexible (SMACNA HVACDCS).

P. UL 181 - Factory-Made Air Ducts and Connectors.

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, NFPA 90B and NFPA 96 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. Flexible Ducts:
1. Flexible Technologies - Thermaflex product line.
2. Buckley Associates - Flexmaster Triple-Lock Buck Duct product line.
3. No Substitutions.

B. Plastic Drawbands:
1. Panduit.
2. Thomas and Betts.
3. Tyton.

C. Tape for Flexible Ducts:
1. Ideal Tape Co., Inc.
2. Fasson.
3. Minnesota Mining and Manufacturing (3M).
4. Nashua.
5. Shurtape.
6. Venture.

D. Manufactured Ductwork - Round and Flat Oval:
1. McGill AirFlow LLC, a subsidiary of United McGill Corporation.
2. Aero Heating & Ventilating, Inc.; Portland, ME.
3. Central City Sheet Metal; Brewer, Caribou, and Gorham, ME.

4. Hahnel Brothers; Bangor and Lewiston, ME.
5. Hranec Corporation; Uniontown, PA.
6. Monroe Metal Mfg. Inc.; Monroe, NC.
7. Northeastern Sheet Metal Inc.; Goffstown, NH.
8. Semco Inc., division of the Flakt Woods Group.
9. Sheet Metal Connectors Inc.; Minneapolis, MN.
10. Spiral Manufacturing Co. Inc.; Minneapolis, MN.
11. No Substitutions.

E. Manufactured Ductwork - Transverse Duct Connection System:
1. Ductmate.
2. HFC Enterprises; Covina, CA - round and flat oval ducts only.

F. Sealants:
1. Hardcast, a division of Carlisle Corporation.
2. Ductmate.
3. Mon-Eco Industries, Inc - Eco product line.
4. Foster.
5. McGill AirSeal LLC, a subsidiary of United McGill Corporation.
6. Minnesota Mining and Manufacturing (3M).
7. 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).

B. Aluminum Ducts: ASTM B209; aluminum sheet, alloy 3003-H14. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or of equivalent strength.

2.3 FLEXIBLE DUCTS

A. Insulated Flexible Ducts:
1. Semi-Rigid Flexible Aluminum Ductwork:
a. Flexmaster Triple-Lock Buck Duct - Insulated.
b. Triple lock mechanical joint aluminum flex duct, constructed entirely without the use of adhesive.
c. Fiberglass insulation and fire-retardant polyethylene vapor retarder film.
d. Pressure Rating: 12 inches WG (2988 Pa) positive for all sizes, 12 inches WG (2988 Pa) negative for sizes thru 16" diameter (406 mm), 8 inches WG (1992 pa) negative for sizes 18" (457 mm) and 20" (508 mm).
e. Maximum Velocity: 5500 fpm (27.9 m/sec).
f. Inside bend radius: Minimum one diameter.
g. Temperature Range: -40EF to 250EF (-40EC to 121EC).

h. UL 181, Class 0 air duct.
i. Meets NFPA 90A and 90B standards.

2. Fabric-Core Flexible Ductwork:
   a. Thermaflex Model M-KC.
   b. Greenguard certified.
   c. UL 181, Class 1, heavy fiberglass cloth fabric supported by helically wound spring steel wire; fiberglass insulation; reinforced metalized vapor barrier film.
   d. Pressure Rating: 10 inches WG (2.5 kPa) positive and 2.0 inches (500 Pa) negative.
   e. Maximum Velocity: 6000 fpm (30.4 m/sec).
   f. Temperature Range: -20EF to 250EF (-28EC to 121EC).

B. Non-Insulated Flexible Ducts:
1. Semi-Rigid Flexible Aluminum Ductwork:
   a. Flexmaster Triple-Lock Buck Duct - Bare.
   b. Triple lock mechanical joint aluminum flex duct, constructed entirely without the use of adhesive.
   c. Pressure Rating: 12 inches WG (2988 Pa) positive for all sizes, 12 inches WG (2988 Pa) negative for sizes thru 16" diameter (406 mm), 8 inches WG (1992 pa) negative for sizes 18" (457 mm) and 20" (508 mm).
   d. Maximum Velocity: 5500 fpm (27.9 m/sec).
   e. Inside bend radius: Minimum one diameter.
   f. Temperature Range: -40EF to 250EF (-40EC to 121EC).
   g. UL 181, Class 0 air duct.
   h. Meets NFPA 90A and 90B standards.

C. Return and Exhaust: Use either semi-rigid flexible aluminum type (insulated or bare), or fabric-core type (insulated). Non-insulated fabric-core type does not have adequate negative pressure rating.

2.4 ACCESSORIES

A. Drawbands for Flexible Ducts:
1. Stainless Steel: 1/2-inch (13 mm) wide with screw-driven worm gear.
2. Plastic: Panduit PLT5H or PLT8H; Thomas and Betts Dukt-Rap, VAL-26-50, or VAL-275X-25; or Tyton T150L or LX. Install with manufacturer-s lever-action tightening tool.

B. Tape for Flexible Ducts: Ideal-Seal 587A/B, UL 181B-FX, aluminum foil with pressure-sensitive acrylic adhesive, -20EF to 250EF (-28EC to 121EC) temperature range.

C. Fasteners: Rivets, bolts, or sheet metal screws.

D. Sealants: See Duct Sealant portion of this Specification.

E. Hanger Rod: ASTM A36; galvanized steel; threaded both ends, threaded one end, or continuously threaded.

F. Wire Rope Hanging System: At the Contractor=s option, Ductmate Industries= Clutcher and EZ-Lock hanger system may be used with Ductmate wire rope (no substitutions). System use and installation shall conform with manufacturer=s requirements. System shall not be painted or otherwise coated. System shall not be used in corrosive environments.

2.5 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.

2.6 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufactured ductwork and fittings listed below are acceptable alternatives to standard ductwork systems. For exposed round and flat oval ductwork, factory-manufactured ductwork and fittings are required.

B. Manufacture in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

C. Exposed Round and Flat Oval Ductwork: Shall be manufactured ductwork by one of the listed manufacturers.
   1. Spiral Ductwork Acceptable Products:
      a. McGill Airflow: Standard Uni-Seal product line (smooth surface between spiral lockseams) or Uni-Rib product line (one standing seam reinforcement between each pair of spiral lockseams).
      b. Monroe Metal Inc.: Standard spiral product line (smooth surface between spiral lockseams). V-Rib product line is not allowed.
      c. Other Manufacturers: Standard spiral product line (smooth surface between spiral lockseams).
      d. Ductwork and fittings shall be products of a single manufacturer.

D. Exposed Ducts:
   1. Select and handle materials with care for a neat appearance.
   2. Joint connections on round and flat oval ducts shall be sleeve or flanged type; drawbands are not acceptable. Joint connections on flat oval ducts 42 inches and wider shall be flanged type to ensure tight fit and good appearance.
   3. Provide exterior reinforcing only where required, with prior approval from the Architect.
   4. External reinforcement of flat-oval ducts shall be full-perimeter angle rings. Straight angles along flat sides only are not allowed.

E. Galvanized and stainless steel sheet metal used in fabrication shall be not less than 26 gauge thickness. Aluminum shall be not less than 0.025 in. nominal thickness. This requirement supersedes SMACNA requirements.

F. Round and Flat Oval Duct and Fittings:
   1. Shall be suitable for at least 4 in. WG positive pressure and 2 in. WG negative pressure in accordance with SMACNA HVACDCS standards. This is a minimum; provide higher ratings where required.
   2. Fittings shall be fabricated of sheet metal at least one gauge heavier than straight duct of the same size.
   3. Fittings shall be factory-sealed so that no field sealing of joints between gores or segments is required. Acceptable methods of construction are fully welded, spot-welded with inner sealant, or standing-seam crimped joints.

G. Radiused Elbows in Round and Flat Oval:
   1. In exposed ductwork shall be non-adjustable type, factory-sealed.
   2. In concealed ductwork may be adjustable type, with full long radius as detailed on the Drawings. Short-radius elbows are not allowed.

3. Shall be constructed of the following minimum number of segments or gores: 90-degree: 4 gores; 60-degree: 3 gores; 45-degree: 3 gores; 30-degree: 2 gores; 22-1/2-degree: 2 gores.
4. 1-piece stamped elbows are acceptable up to 12 inches diameter. Pleated elbows are acceptable up to 10 inches diameter.

H. Mitered Elbows in Round and Flat Oval:
1. Available in both 90-degree and 45-degree elbows.
2. Shall have minimum number of welded single-wall vanes as follows (size is duct width in plane of bend):
   a. 3 to 9 inch: 2.
   b. 10 to 14 inch: 3.
   c. 15 to 19 inch: 4.
   d. 20 to 60 inch: 5.
   e. Larger Sizes: 12-inch maximum spacing.

I. Inner tie-rod reinforcement is not allowed. Increase duct sheet metal gauge or external reinforcement as required.

J. Transverse Duct Connection System: SMACNA "F" rated or SMACNA "J" rated rigidity class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips. Product shall be Ductmate factory-manufactured connectors, or field-formed flanges using a specialized machine.

2.7 CASINGS

A. Fabricate casings in accordance with SMACNA HVACDCS and construct for operating pressures indicated.

B. Mount floor mounted casings on 4 inch (100 mm) high concrete curbs. At floor, rivet panels on 8 inch (200 mm) centers to angles. Where floors are acoustically insulated, provide liner of 18 gauge (1.20 mm) galvanized expanded metal mesh supported at 12 inch (300 mm) centers, turned up 12 inches (300 mm) at sides with sheet metal shields.

C. Reinforce door frames with steel angles tied to horizontal and vertical plenum supporting angles. Install hinged access doors where indicated or required for access to equipment for cleaning and inspection.

D. Fabricate acoustic casings with reinforcing turned inward. Provide 16 gauge (1.50 mm) back facing and 22 gauge (0.80 mm) perforated front facing with 3/32 inch (2.4 mm) diameter holes on 5/32 inch (4 mm) centers. Construct panels 3 inches (75 mm) thick packed with 4.5 lb/cu ft (72 kg/cu m) minimum glass fiber media, on inverted channels of 16 gauge (1.50 mm).

2.8 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.

2.9 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. Foster: Duct-Fas or Safetee mastic sealant. Duct-Fas is UV resistant and recommended for applications exposed to sunlight.
6. 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.
7. Polymer Adhesives Sealant Systems: Airseal No. 11 premium sealant.

2.10 UNIFORMITY OF MATERIALS

A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, 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. For lined ducts, maintain sizes inside lining.

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. Flexible Ducts:
   1. Connect diffusers or light troffer boots to low pressure supply ducts directly or with 5 feet (1.5 m) maximum length of flexible duct held in place with strap or clamp.
   2. Minimum bend radius shall be one and one half times the duct diameter. Support the bend to maintain this radius.
   3. Bends shall not exceed 45 degrees.
   4. Connect flexible ducts to metal ducts with 2 turns of duct tape and metal draw bands. Plastic drawbands may be used if they are installed using the band manufacturer-s lever-action tightening tool. On insulated flexible ducts, provide an additional seal of tape and drawband on the insulation-s vapor barrier.

K. 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.

L. 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.

M. 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

N. Provide floor drains in generator ventilation intake and exhaust plenums. Pitch bottom of plenums to floor drains and provide deep seal traps. Pipe traps to nearest floor drains.

O. Install duct-mounted components furnished under other Sections of this Specification, such as smoke dampers, control dampers, control sensors, and smoke detectors. Install with straight lengths of duct as required for proper operation. Provide access at such components as required. Install in accessible locations for maintenance; notify the Architect if a location indicated or selected requires addition of access by other trades.

3.2 SCHEDULES

A. Ductwork Material Schedule

AIR SYSTEM	MATERIAL
Low Pressure Supply (Heating Systems)	Galvanized Steel, Aluminum,
Low Pressure Supply (System with Cooling Coils)	Galvanized Steel, Aluminum,
Return and Relief	Galvanized Steel, Aluminum
General Exhaust	Galvanized Steel, Aluminum
Outside Air Intake	Galvanized Steel, Aluminum
Emergency Generator Ventilation	Galvanized Steel, Aluminum

B. Ductwork Pressure Class Schedule

AIR SYSTEM	SMACNA PRESSURE CLASS
Supply (Heating Systems)	2 inch (500 Pa)
Supply (System with Cooling Coils)	2 inch (500 Pa)
Return and Relief	1 inch (250 Pa)
General Exhaust	1 inch (250 Pa)

Outside Air Intake	1 inch (250 Pa)
Emergency Generator Ventilation	1 inch (250 Pa)

END OF SECTION 233113

SECTION 233300 – AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Backdraft Dampers.

B. Counterbalanced Dampers.

C. Volume Control Dampers.

D. Casings and Plenums.

E. Duct Access Doors.

F. Duct Sleeves, Prepared Openings and Closure Collars.

G. Duct Test Holes.

H. Flexible Duct Connections.

I. Round Duct Branch Taps.

J. Turning Vanes.

1.2 RELATED SECTIONS

A. Division 01 Section “Operation and Maintenance Data.”

B. Division 07 Section “Through-Penetration Firestop Systems.”

C. Division 23 Section “Metal Ducts.”

D. 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 70 - National Electrical Code.

E. SMACNA - HVAC Duct Construction Standards - Metal and Flexible, Third Edition - 2005

(HVACDCS).

1.4 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate for shop fabricated assemblies including volume control dampers, duct access doors and duct test holes.

C. Product Data: Provide for shop fabricated assemblies including volume control dampers, duct access doors, duct test holes and hardware used. Include electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate for fire dampers and combination fire and smoke dampers.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Record actual locations of access doors and 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 Section “Product Requirements.”

B. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Dampers:
1. Ruskin.
2. Air Balance, Inc.
3. Arrow.
4. Cesco.
5. Greenheck.

6. NCA.
7. Tamco.
8. Ventex.
9. Vent Products, Inc.

2.2 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.

2.3 BACKDRAFT DAMPERS

A. Gravity Backdraft Dampers, Size 18 x 18 inches (450 x 450 mm) or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

B. Multi-Blade, Parallel Action Gravity Backdraft Dampers: Frames of 16 gage (1.5 mm) thick galvanized steel, or extruded aluminum, with blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball or sintered bronze bearings, and plated steel pivot pin. Pressure and velocity ratings shall be suitable for the application.

2.4 COUNTERBALANCED DAMPERS

A. Multi-Blade, Parallel Action Gravity Balanced Counterbalanced Dampers: Frames of 16 gage (1.5 mm) thick galvanized steel, or extruded aluminum, with blades of maximum 6 inch (150 mm) width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball or sintered bronze bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure. Pressure and velocity ratings shall be suitable for the application.

2.5 VOLUME CONTROL DAMPERS

A. Fabricate in accordance with SMACNA HVACDCS, and as specified or as indicated on the drawings.

B. Shop fabrication is permitted for single blade dampers.

C. Height is the dimension perpendicular to the blade rod or shaft. Width is the dimension parallel to the blade rod.

D. Single Blade Dampers: For duct sizes (height x width) up to 7 x 30 inch (175 x 760 mm). When height or width exceeds its respective maximum, provide multi-blade damper.

E. Multi-Blade Damper: Opposed blade pattern with maximum blade sizes (height x width) 8 x 72 inch (200 x 1825 mm). Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ductwork 12 inches (300 mm) and smaller, provide end bearings.

On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

G. Quadrants:
1. Manufacturers:
a.) Duro-Dyne.
b.) Ventfabrics.
2. Duro-Dyne Specline SR and SRH series; Quadline series; or Stampline dial regulators and wedge-loc regulators. Or equal by Ventfabrics. Factory-manufactured dampers shall have damper manufacturer's choice of quadrant equal to the Duro-Dyne products specified.
3. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Regulators shall include lever handle, locking wing nut and graduated indicator dial. Provide shaft seals, bushings, or gaskets for duct penetrations. Quadrants without these features are not allowed.
4. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters, with open space to run insulation through.
5. Where rod lengths exceed 30 inches (750 mm) provide regulator at both ends.

H. Remote Manual Operators:
1. Manufacturers:
a.) Young Regulator Company.
2. Cable Type with Rack and Pinion: Bowden remote cable assembly, including rack and pinion controllers at damper and ceiling, galvanized angle bracket for duct mounting, stainless pull wire with galvanized steel flexible outer casing, and 2-5/8" zinc cup with 3" cover plate.
3. Cable Type with Worm Gear Actuator: Model 1200-FS with worm gear operator for duct mounting, flexible shaft, and concealed ceiling cup and cover.
4. Rigid Shaft Type with Worm Gear Actuator: 927 or 1200 series worm gear assembly, 301 or 315 series concealed ceiling regulator with cup and cap, and square connecting rod.
5. Cover Plate Finish: Selected by Architect, from manufacturer's standard offerings including zinc plated, chrome plated, stainless steel, and primer painted.

I. Provide required operating wrenches for balancing, and furnish to the Owner at project completion.

2.6 CASINGS AND PLENUMS

A. Factory fabricate components with field installation. The plenum or casing manufacturer shall provide certified testing data, obtainable directly from an independent acoustical laboratory, listing sound absorption and transmission loss characteristics of panel assembly. Sound absorption coefficients and sound transmission loss, determined by an independent laboratory, shall be in accordance with ASTM C 423 and ASTM E 90 respectively.

2.7 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 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. Medium- and High-Pressure Positive-Pressure Ducts:
1. Ruskin ADHP-3 high pressure access door rated up to 12 in. WG (2985 Pa), with spring latches to allow the door to open temporarily to relieve negative pressures.
2. Provide in positive-pressure systems with specified pressure class above 2 in. WG (498 Pa).

E. Access doors with sheet metal screw fasteners are not acceptable.

F. 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.

2.8 DUCT SLEEVES, PREPARED OPENINGS AND CLOSURE COLLARS

A. Duct Sleeves and Closure Collars: Fabricate from minimum 20-gage (1.0 mm) galvanized steel or equivalent thickness of aluminum, select material to match duct material. Where sleeves are installed in bearing walls, provide structural steel sleeves.

B. Prepared Openings: Provide one-inch clearance between the duct and the sleeve.

2.9 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.

2.10 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.

2.11 ROUND DUCT BRANCH TAPS AND SPIN-IN FITTINGS

A. Saddle Taps: For round ducts branching off main ducts at 90 degrees, provide factory fabricated, saddle-tap fittings with conical or bellmouth taps, or 45-degree rectangular-to-round branch fittings. For round ducts branching off at 45 degrees, fittings do not require conical or bellmouth expansion. Fittings shall be furnished with flange for fastening and sealing designed to overlap onto adjacent duct, and shall be shaped to fit tight to the exterior of the duct, flat for rectangular duct, curved for round duct.

B. Spin-in fittings, factory-fabricated with conical or bellmouth taps are an acceptable substitute for saddle taps.

C. Factory-fabricated taps and spin-ins may be furnished with integral volume dampers and quadrants as specified in paragraph “Manual Dampers” in this Section.

2.12 TURNING VANES

A. Manufacturers for Turning Vanes and Vane Rails:
1. Duro Dyne - Junior Vane Rail.
2. Ductmate Industries - PROrail 2-inch Turning Vane Rail.
3. Hardcast, a division of Carlisle Corporation - Dyn-O-Rail Jr.

B. Factory-fabricated and factory-or-field-assembled units consisting of curved turning vanes for uniform air distribution and change of direction with minimum turbulence and pressure loss. Provide curved single thickness vanes for mitered elbows with change in direction of 45 degrees or

greater, conforming to SMACNA HVACDCS single vane schedule for small vanes. Each vane shall form a 90-degree arc. Fill the entire duct cross-section with vanes. Orient leading edge of vanes parallel to the side of the duct (directed straight into the entering airstream). Turning vanes shall be minimum 16 gauge (1.61 mm), regardless of gauges that are recommended by SMACNA. Double thickness turning vanes are not allowed.

C. Turning vanes in rectangular ductwork and shop-fabricated round ductwork shall conform with details on the Drawings. If not detailed, the SMACNA detail for small-radius small-spacing single-thickness vanes shall be used.

D. Turning vanes in manufactured round and flat oval duct elbows shall be the duct manufacturer's standard size, spacing, and gauge, but must be single-wall and not less than 16 gauge (1.61 mm).

E. Factory-fabricated turning vane rails shall be a minimum of 24 gauge (0.7 mm) galvanized steel.

F. Material for vanes and rails shall be the same as the duct sheet metal.

2.13 UNIFORMITY OF MATERIALS

A. Ductwork accessories, including but not limited to volume dampers, smoke dampers, fire dampers, combination fire/smoke dampers, backdraft dampers and motorized dampers, shall be fabricated of materials that are similar to the ductwork in which they are installed.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2 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 return air, exhaust air and fresh air intake ductwork to facilitate the removal of accumulations of dust and combustible materials in accordance with NFPA 90A. Install access doors at maximum 20 foot (6 m) intervals and at the base of each vertical riser.

C. Provide duct access doors for inspection, servicing, and cleaning before filters, before and after coils, before and after fans, before automatic dampers, at multiple blade volume dampers, at backdraft and counterbalanced dampers, and elsewhere as specified or as indicated on the Drawings. Provide minimum 8 x 8 inch (200 x 200 mm) size for hand access, 18 x 18 inch (450 x 450 mm) size for shoulder access, and as specified or as indicated on the Drawings. Review locations prior to fabrication.

D. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

E. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

F. Provide balancing dampers on duct take-offs to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly. Where branch duct is completely above non-accessible wallboard ceiling and the Architect has not approved the use of access doors, duct mounted balancing dampers shall not be required.

G. For volume dampers located above suspended ceilings and in areas that are not visible to building occupants (e.g. mechanical rooms), provide fluorescent orange colored surveyor-s tape. Permanently attach tape to damper handles and run tape down to 10 in. (254 mm) above ceiling or 12 in. (304 mm) below damper handle where ceilings do not exist (e.g. mechanical rooms).

H. 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. [For fans developing static pressures of 5.0 in. w.g. (1250 Pa) and over, cover connections with leaded vinyl sheet, held in place with metal straps.]

I. Duct Sleeves and Prepared Openings: Install for ducts passing through roofs, ceilings, walls and floors. Field determine the proper size and location of sleeves and prepared openings.
   1. Duct Sleeves: Allow one-inch (25 mm) clearance between duct and sleeve or one-inch (25 mm) clearance between insulation and sleeve for insulated ducts, except at grilles, registers, and diffusers.
   2. Prepared Openings: Allow one-inch (25 mm) clearance between duct and opening or one-inch (25 mm) clearance between insulation and opening for insulated ducts, except at grilles, registers, and diffusers.

J. Closure Collars:
   1. Provide not less than 4 inches (100 mm) wide on each side of walls or floors where sleeves or prepared openings are installed. Fit collars snugly around ducts. Grind smooth edges of collar to prevent tearing or puncturing insulation covering or vapor barrier.
   2. Where insulated ducts penetrate non-fire-rated walls, insulation shall be continuous through the closure collars and the closure collars shall be installed tight to the insulation.
   3. Where insulated ducts penetrate fire rated walls, insulate ducts on both sides of closure collars and seal points of contact between closure collar and insulation with vapor proof adhesive.
   4. Where ducts penetrate fire rated walls, provide fire proof sealant at closure collar. Refer to Division 07 Section “Through Penetration Firestop Systems,” for fire proof sealant requirements.
   5. Secure closure collars to ducts with sheet metal screws at maximum 6-inch (152 mm) centers and secure closure collars to walls or floors with sheetrock screws, nails or other appropriate fastener at maximum 6-inch (152 mm) centers.
   6. Packing: Pack with non-combustible glass fiber insulation in spaces between sleeve/opening and duct/duct insulation. Cover or seal edges of packing to contain loose fibers.

K. 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. 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 Ducts: Support ducts by hangers every 3 feet (0.9 m), unless supported by ceiling construction. Stretch flexible air ducts to smooth out corrugations, and long radius elbows, where possible, using a minimum length to make connections.
2. 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.
3. Ducts with Extra Weight Such As Lead Lining or Lagging: Include the extra weight in determination of suitable hangers and supports.

L. Provide duct test holes where indicated and required for testing and balancing purposes.

M. Provide interconnecting power and control wiring as required, in accordance with Division 26.

END OF SECTION 233300

SECTION 233700 - AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Registers/Grilles.

B. Louvers.

C. Roof Caps.

D. Goosenecks.

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, Grilles, and Drum Louvers:
1. Anemostat.
2. Krueger.
3. Metalaire.
4. Price.

B. Louvers:
1. Greenheck.
2. American Warming and Ventilating.
3. Arrow.
4. Ruskin.

C. Roof Caps:
1. Greenheck.
2. Acme.
3. Loren Cook.

2.2 SUPPLY REGISTERS/GRILLES

A. Type: Streamlined and individually adjustable blades, 3/4 inch (19 mm) minimum depth, 3/4 inch (19 mm) maximum spacing with spring or other device to set blades, vertical or horizontal face as scheduled, double deflection.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw or concealed mounting and gasket.

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, with factory off-white baked enamel finish.

D. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.3 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES

A. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch (13 x 13 x 13 mm) louvers.

B. Frame: 1-1/4 inch (32 mm) margin with countersunk screw mounting. Channel lay-in frame for suspended grid ceilings.

C. Fabrication: Aluminum with factory off-white baked enamel finish.

D. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.4 LOUVERS

A. Louvers shall be acoustical type equal to, and shall have free areas no less than, Greenheck model AFA-801. For reference, free area of a model AFA-801 in 48"x48" (1.2 m x 1.2 m) size is 5.21 sq. ft (0.48 m2).

B. Free area velocity at beginning of water penetration shall be at least 879 fpm (4.46 m/sec). Testing shall be in accordance with AMCA Standard 511, using a 48"x48" (1.2 m x 1.2 m) louver. Beginning of water penetration is defined by AMCA as 0.01 oz. per sq. ft (3 g/m2).

C. Type: 8 inch (203 mm) deep with airfoil acoustical blades on approximately 45 degree slope, heavy channel frame, removable expanded aluminum bird screen with 1/2 inch (13 mm) mesh mounted on interior face.

D. Fabrication: 0.080-inch (2.03 mm) thick 6063-T5 extruded aluminum alloy, mechanically fastened assembly. Blades shall be filled with fiberglass acoustical insulation. Underside of blades, facing away from outdoors and toward noise-generating equipment, shall be perforated.

E. Mounting: Furnish with standard box frame and angles for installation.

F. Finish: Factory 2-coat Kynar or Hylar fluoropolymer spray (with at least 70% PVDF) finish. Submit manufacturer-s standard color chart. The Architect will select color.

G. Sound performance shall be as scheduled on the Drawings. Transmission loss (TL) shall be tested in accordance with ASTM E90-04. Sound transmission class (STC) shall be determined in accordance with ASTM E413-04.

H. Acoustic louvers shall bear the AMCA rating seal for water penetration, sound, and air performance.

2.5 ROOF CAPS

A. Roof caps shall be equal to Greenheck Model GRS spun aluminum type. Pressure drop through hood shall not exceed that of the Greenheck GRS.

B. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

C. Fabricate hood of spun aluminum with galvanized steel internal reinforcements, aluminum windband and curb cap, and aluminum birdscreen with 1/2 inch (13 mm) square mesh. Mill aluminum finish.

D. Windband shall have rolled edge for rigidity. Curb cap shall have deep spun inlet venture for low pressure drop. Curb cap shall have at least 2 holes on each side for fastening to curb.

E. Provide with rubber seal for installation between cap and curb.

F. Provide hex-head fasteners to curb in each hole in curb cap. Provide protection between dissimilar metals.

2.6 GOOSENECKS

A. Fabricate in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, of minimum 18 gauge (1.20 mm) galvanized steel.

B. Mount on minimum 12 inch (300 mm) high curb base where size exceeds 9 x 9 inch (230 x 230 mm).

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 234100 – PARTICULATE AIR FILTRATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Disposable, Pleated-Media Extended Area Panel Filters.

1.2 RELATED SECTIONS

A. Division 01 Section “Temporary Facilities and Controls”: Filters for temporary heating and ventilating.

1.3 REFERENCES

A. ARI 850 - Commercial and Industrial Air Filter Equipment.

B. ASHRAE 52.2-2007 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

C. UL 900 - Test Performance of Air Filter Units.

1.4 DEFINITIONS

A. MERV: Minimum Efficiency Reporting Value, in accordance with ASHRAE Standard 52.2.

B. MERV-A: Minimum Efficiency Reporting Value, in accordance with ASHRAE Standard 52.2 Appendix J, using an aerosol to neutralize electrostatic charge.

1.5 PERFORMANCE TOLERANCES

A. Conform to ARI 850 Section 7.4.

B. Particle Size Efficiency: Plus or minus 5 percent, relative to the ASHRAE 52.2-2007 rating standards.

1.6 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

C. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

1.7 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

B. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.8 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories Inc., as suitable for the purpose specified and indicated.

1.9 EXTRA MATERIALS

A. Furnish under provisions of Division 01 Section “Closeout Procedures.”

B. Provide one set of disposable panel filters.

PART 2 - PRODUCTS

2.1 GENERAL

A. Filter efficiency (MERV) ratings shall be in accordance with ASHRAE Standard 52.2-2007. Filter ratings shall incorporate particle size vs. efficiency.

B. Particulate Filters (other than electrostatic precipitators):
1. Ratings shall be MERV-A in accordance with the Standard’s Appendix J (part of Addendum B, approved in 2008), which requires a conditioning step using a KCl aerosol to neutralize electrostatic charge.
2. If the manufacturer has not completed MERV-A testing, submittals shall include a statement that the filtration and MERV rating are entirely mechanical and does not rely on an electrostatic charge.
3. Fine fiber media, which maintain their efficiency over time, are required, as opposed to coarse-fiber media which rely on electrostatic charge and lose efficiency over time as the charge dissipates.

2.2 MANUFACTURERS

A. Filters, Frames, and Housings:
1. Camfil Farr.
2. AAF International (American Air Filter and AAF brands).
3. Airguard - a Clarcor company.
4. Eco-Air - division of Flanders Corporation.
5. Flanders Corporation.
6. Purolator - a Clarcor company.
7. No substitutions.

2.3 DISPOSABLE, PLEATED-MEDIA EXTENDED AREA PANEL FILTERS

A. Product: Camfil Farr 30-30.

B. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to wire grid.
1. Frame: High-wet-strength beverage board.

2. Pleats: Rounded radial type for full usage of media area.
3. Nominal thickness: 2 inches (50 mm), unless otherwise indicated.

C. Performance Ratings:
1. MERV (ASHRAE 52.2): 8.
2. MERV-A (ASHRAE 52.2, Appendix J): 8.
3. Maximum Initial Resistance:
a. At 350 Fpm (1.78 m/sec) Face Velocity:
1) 1-inch-thick (25 mm) Filter: 0.23 inch WG (77 Pa).
b. At 500 Fpm (2.54 m/sec) Face Velocity:
1) 2-inch-thick (25 mm) Filter: 0.31 inch WG (77 Pa).
2) 4-inch-thick (50 mm) Filter: 0.27 inch WG (77 Pa).
4. Recommended Final Resistance: 1.0 inch WG (249 Pa).
5. Guaranteed Pressure Drop Without Failure: 2.0 inch WG (498 Pa).
6. Maximum Operating Temperature: 180°F (82°C) continuous, 200°F (93°C) intermittent.
7. Total Media Area, 24”x24” (610 mm x 610 mm) Nominal Size:
a. 1-inch (12.5 mm) Thick: 9.8 sq. ft (0.9 m^2).
b. 2-inch (25 mm) Thick: 17.3 sq. ft (1.6 m^2).
c. 4-inch (25 mm) Thick: 27.7 sq. ft (2.5 m^2).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Provide new filters in air handling systems immediately before the systems are balanced by the approved balancing contractor. Air handling systems shall be balanced with clean filters.

D. Do not operate fan system until filters (temporary or permanent) are in place. Once air handling systems are in operation and before substantial completion, provide filter replacement as required. Filters shall be replaced when their pressure drop (as measured by the approved balancing Subcontractor) reaches the manufacturer-s recommended changeout pressure drop. At the time of substantial completion, provide air handling systems with a new set of filters. After substantial completion, provide any air handling systems that are subjected to significant dust and debris as a result of continued construction with filter changeouts as specified above, and provide new filters when construction is completed.

END OF SECTION 234100

SECTION 238123 – COMPUTER-ROOM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Computer Room Air Conditioners (CRACs) will be prepurchased by the Owner, and assigned to the Contractor.

B. The Contractor will, upon receiving the CRACs, take complete responsibility for them, including but not limited to receiving, rigging, installation, charging, startup, testing, and warranty support and service. Warranty support and service shall include the standard warranty of the Contractor's installation, as well as any warranties both standard and extended which are provided as part of the Owner's purchase of the CRACs.

1.2 SECTION INCLUDES

A. Air conditioning units installation.

B. Controls and control panels.

1.3 RELATED SECTIONS

A. Division 09 Section "Access Flooring."

B. Division 23 Section "Common Motor Requirements for HVAC Equipment."

C. Division 23 Section "Refrigerant Piping."

D. Division 23 Section "Instrumentation and Control for Mechanical Systems."

E. Division 26 "Electrical".

1.4 REFERENCES

A. ASHRAE 52 - Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter.

B. ASME SEC 8D - Boilers and Pressure Vessel Codes - Rules for Construction of Pressure Vessels.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

D. NFPA 70 - National Electrical Code.

E. NFPA 75 - Protection of Electronic Computer/Data Processing Equipment.

F. NFPA 90A - Installation of Air Conditioning and Ventilation Systems.

G. UL - Underwriters Laboratories.

1.5 SUBMITTALS

A. Submit under provisions of Division 01 Section “Submittal Procedures.”

B. Shop Drawings: Indicate manufactured products and assemblies. Indicate piping and utility rough-in connections, and electrical characteristics and connection requirements.

C. Product Data: Provide manufacturers literature and data indicating piping, utility, and electrical characteristics and connection requirements.

1.6 SUBMITTALS FOR CLOSEOUT

A. Submit under provisions of Division 01 Section “Closeout Procedures.”

B. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data. Submit under provisions of Division 01 Section “Operation and Maintenance Data.”

C. Startup Reports: Include reports of Contractor’s startup and manufacturer’s representative’s startup.

1.7 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum three years experience.

1.8 REGULATORY REQUIREMENTS

A. Conform to NFPA 90A for the installation of computer room air conditioning units.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters' Laboratories, Inc., as suitable for the purpose specified and indicated.

1.9 DEFINITIONS

A. MERV: Minimum Efficiency Reporting Value (air filter rating), in accordance with ASHRAE Standard 52.2.

B. MERV-A: Minimum Efficiency Reporting Value (air filter rating), in accordance with ASHRAE Standard 52.2 Appendix J, using an aerosol to neutralize electrostatic charge.

1.10 EXTRA MATERIALS

A. Division 01 Section “Closeout Procedures.”

B. Spare Set of Filters for Each Unit: 2 sets will be furnished with the units. Install one set during testing and balancing, and furnish the other one to the Owner.

PART 2 - PRODUCTS

2.1 GENERAL

A. Air conditioning units as described herein will be prepurchased by the Owner and assigned to the Contractor. The unit description is provided for the Contractor's information.

2.2 MANUFACTURER

A. Liebert.

2.3 AIR CONDITIONING UNITS

A. Description: Packaged, air-cooled, factory assembled, pre-wired and pre-piped unit, consisting of cabinet, fans filters, humidifier, and controls.

B. Assembly: Up-flow air delivery, in draw-through configuration.

C. Heat Rejection: Provide air-cooled remote condenser.

2.4 REFRIGERANT

A. The system shall be designed for use with R-407C refrigerant, which meets the EPA clean air act for phase-out of HCFC refrigerants. Refrigerant and compatible oil shall be field supplied and field charged on air-cooled systems; factory charged on glycol-cooled systems with integral condensers.

2.5 CABINET AND FRAME

A. Structural Frame: Welded steel suitably braced for rigidity, capable of supporting compressors and other mechanical equipment and fittings.

B. Doors and Access Panels: Steel with polyurethane gaskets, hinges to allow removal of panels, and concealed fastening devices. 1/4-turn fasteners on front panels (and any side panels that are for normal maintenance).

C. The exterior panels shall be insulated with a minimum 1 in. (25mm) thick, 1.5 lb/cu.ft (24.0 kg/m3) density neoprene-coated fiber insulation.

D. Finish of Exterior Surfaces: Baked-on enamel; manufacturer's standard color.

2.6 EVAPORATOR FANS AND MOTORS

A. Fans: Centrifugal type, double width double inlet, statically and dynamically balanced as a completed assembly to a maximum vibration level of two mils in any plane. The shaft shall be heavy duty steel with self-aligning pillow block ball bearings with a minimum L3 life of 200,000 hours. The fans shall be located to draw air over the A-Frame coil to ensure even air distribution and maximum coil performance. A static regain duct shall be factory-installed to the bottom of the blower.

B. Motor:

1. 1750 RPM, mounted to an automatic, spring-tensioning base. The motor shall be removable from the front of the cabinet.
2. Premium Efficiency Motor: The fan motor shall be Open Drip-Proof, Premium efficiency and shall meet NEMA Premium standard.

C. V-Belt Drive Package:
1. The motor sheave and fan pulley shall be double-width fixed pitch, with two belts, sized for 200% of the fan motor horsepower. An auto-tension system shall provide constant tension on the belts. Belts, shaft, blower bearings, sheave and pulley shall be warranted for five years (parts only).

D. Refer to Division 23 Section "Common Motor Requirements for HVAC Equipment."

2.7 RETURN GRILLES

A. The indoor unit cabinet shall include factory-furnished return air grilles. Grilles shall be painted to match or compliment unit exterior color.

B. Grilles shall be located on the front of the unit.

2.8 DUAL REFRIGERATION SYSTEM

A. Each unit shall include two (2) independent refrigeration circuits and shall include hot gas mufflers (semi-hermetic compressors units only), liquid line filter driers, refrigerant sight glass with moisture indicator, externally equalized expansion valves and liquid line solenoid valves. Compressors shall be located outside the airstream and shall be removable and serviceable from the front of the unit.

B. Hot Gas Bypass Valve: Installed between compressor discharge and leaving side of expansion valve through a side-outlet distributor. With the refrigeration circuit under full load, pressure on the leaving side of the valve shall keep the port closed. Under part load, the pressure on the diaphragm shall overcome the spring pressure of the seat, allowing some hot gas to mix with the normal liquid discharge of the expansion valve, raising the evaporator pressure.

2.9 COMPRESSORS

A. Semi-Hermetic Compressors With Four-Step Unloaders Control: Semi-hermetic (serviceable) with a suction gas cooled motor, vibration isolators, thermal overloads, oil sight glass, automatic reset high pressure switch with control lockout after three failures, pump-down low pressure transducer, suction line strainer, service valves, reversible oil pumps for forced feed lubrication, a maximum operating speed of 1750 RPM. Compressors shall include cylinder unloaders, activated by solenoid valves which are controlled from the microprocessor control. In response to the return air temperature, the microprocessor control shall activate the unloader solenoids and the liquid line solenoids for four stages of refrigeration cooling. The stages shall be: 1) one compressor, partially loaded, 2) two compressors partially loaded, 3) one compressor partially loaded, one compressor fully loaded, 4) two compressors fully loaded. On a call for dehumidification, the microprocessor control shall ensure that at least one compressor is on full for proper humidity control.

B. Crankcase Heaters: The compressors shall include crankcase heaters, powered from the indoor unit electric panel.

C. Compressor Overload: A pair of N/O contacts shall be factory-installed and wired to each compressor to indicate Compressor Overload.

2.10 EVAPORATOR COILS

A. Dual cross-circuited or interlaced circuits, direct expansion cooling coils of seamless copper tubes expanded into aluminum fins in A-frame configuration.

B. Mount coil assembly in stainless steel drain pan.

2.11 REFRIGERANT REHEAT COIL

A. Hot gas refrigerant coil of seamless copper tubes expanded into aluminum fins with three way solenoid valve on first stage refrigerant circuit.

2.12 ELECTRIC REHEAT/HEATING COILS

A. Electric Heating Coils: Low watt density, 304/304 stainless steel fin tubular construction, controlled in three stages.

B. The reheat elements shall be removable from the front of the cabinet.

C. Circuit Protection: Primary and secondary thermal cutouts, differential air pressure switch, and manual reset overload protection, branch circuit over current protection.

2.13 FILTERS

A. Type: Disposable, pleated-media extended-area panel filters.

B. Nominal thickness: 4 inches (100 mm), unless otherwise indicated.

C. Manufacturers:
1. Camfil Farr; Model 30-30.
2. AirGuard; Type DP.
3. American Air Filter; Perfect-Pleat HC M8.
4. Flanders; Pre-Pleat 40.
5. Purolator; Defiant Mark 80-D.
6. No substitutions.

D. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced cotton and synthetic fabric; supported and bonded to wire grid.
1. Frame: High-wet-strength beverage board.
2. Pleats: Rounded radial type for full usage of media area.

E. Performance Ratings:
1. MERV (ASHRAE 52.2): 8.
2. MERV-A (ASHRAE 52.2, Appendix J): 8.

3. Maximum Initial Resistance:
    a. At 350 Fpm (1.78 m/sec) Face Velocity:
        1) 1-inch-thick (25 mm) Filter: 0.23 inch WG (77 Pa).
    b. At 500 Fpm (2.54 m/sec) Face Velocity:
        1) 2-inch-thick (25 mm) Filter: 0.31 inch WG (77 Pa).
        2) 4-inch-thick (50 mm) Filter: 0.27 inch WG (77 Pa).
4. Recommended Final Resistance: 1.0 inch WG (249 Pa).
5. Guaranteed Pressure Drop Without Failure: 2.0 inch WG (498 Pa).
6. Maximum Operating Temperature: 180°F (82°C) continuous, 200°F (93°C) intermittent.
7. Total Media Area, 24"x24" (610 mm x 610 mm) Nominal Size:
    a. 1-inch (12.5 mm) Thick: 9.8 sq. ft (0.9 m^2).
    b. 2-inch (25 mm) Thick: 17.3 sq. ft (1.6 m^2).
    c. 4-inch (25 mm) Thick: 27.7 sq. ft (2.5 m^2).

2.14 HUMIDIFIER

A. Factory-installed inside the indoor unit, with bypass air slots to enable moisture to be absorbed into the air stream. The humidifier shall be removable from the front of the cabinet.

B. Infrared type consisting of high intensity quartz lamps mounted above and out of the water supply. The humidifier pan shall be stainless steel and arranged to be removable without disconnecting high voltage electrical connections. The complete humidifier section shall be pre-piped, ready for field connection to water supply. The humidifier shall be equipped with an automatic water supply system and shall have an adjustable water-overfeed to prevent mineral precipitation. A high-water detector shall shut down the humidifier to prevent overflowing. A factory-provided air-gap shall prevent backflow of the humidifier supply water.

2.15 CONDENSATE PUMP, DUAL FLOAT

A. The condensate pump shall include integral dual-float switches, pump and motor assembly and reservoir. The secondary float shall shut down the pump upon high water condition.

B. Pump Capacity: 100 GPH (6.3 liters/minute) at 20 ft WG (59.8 kPa) head.

C. Power: Factory-wired to the main unit power.

D. Control: Factory-wired to the main unit microprocessor to shut down the unit cooling on a high water condition, display operating conditions, and signal alarms to remote monitoring.

2.16 FLOOR STAND

A. The floor stand shall be constructed of a welded steel frame. The floor stand shall have adjustable legs with vibration isolation pads. The floor stand shall be of height indicated and as required to install unit flush with finished surface of raised floor.

B. The floor stand shall be bolted to the unit frame and floor slab.

2.17 REMOTE AIR-COOLED CONDENSER

A. Air-Cooled Condenser: Outdoor, air cooled, low profile, multiple direct drive, propeller fan type. Sized to balance the heat rejection of the compressor at 95°F ambient. The condenser shall be constructed of aluminum or galvanized steel, and contain a copper tube, aluminum fin coil arranged for vertical air discharge.

B. Lee-Temp System: The winter control system for the air cooled condenser shall be Lee-Temp. The Lee-Temp system shall allow startup and positive head pressure control with ambient temperatures as low as -30°F (-34.4°C). The Lee-Temp package shall include the following components for each refrigeration circuit: insulated receiver, pressure relief valve, head pressure three-way control valve and rotalock valve for isolating the refrigerant charge. The Lee-Temp receiver shall be factory-insulated and shall be field mounted, piped and wired to the air cooled condenser. The Lee-Temp heater shall require a separate power supply of 460 volt, single phase

C. Quiet-Line Condenser: Fan motors shall be 12-pole, 570 RPM, equipped with rain shields and permanently sealed ball bearings. Motors shall include built-in overload protection. Motors shall be rigidly mounted on die-formed galvanized steel supports.

D. Condenser Disconnect Switch: Factory- mounted and wired to the condenser control panel, accessible from the exterior.

2.18 ELECTRICAL PANEL

A. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

B. Control Cabinet: NEMA 250; Type 2 enclosure, UL listed, with piano hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control circuit transformer. 5000 amps RMS short circuit current rating.

C. Disconnect Switch: Non-automatic molded case circuit breaker with handle accessible with panel closed, non-locking.

2.19 LIEBERT iCOM MICROPROCESSOR CONTROL WITH LARGE GRAPHIC DISPLAY

A. The Data-Aire Data Alarm Processor-III (DAP-III) shall be an acceptable substitute when Data-Aire systems are provided.

B. The iCOM unit control shall be factory set-up for Intelligent Control which uses "fuzzy logic" and "expert systems" methods. Proportional and Tunable PID shall also be user selectable options. Internal unit component control shall include the following:
   1. Compressor Short Cycle Control - Prevents compressor short-cycling and needless compressor wear.
   2. System Auto Restart - The auto restart feature will automatically restart the system after a power failure. Time delay is programmable.
   3. Sequential Load Activation - On initial startup or restart after power failure, each operational load is sequenced with a minimum of one second delay to minimize total inrush

current.

4. Hot Water/Econ-O-Coil Flush Cycles - Hot water reheat coils and Econ-O-Coils are periodically flushed to prevent a buildup of contaminants.
5. Predictive Humidity Control - calculates the moisture content in the room and prevents unnecessary humidification and dehumidification cycles by responding to changes in dew point temperature.

C. The iCOM control shall be compatible with Liebert remote monitoring and control devices. Options are available for BMS interface to Modbus, Jbus, BACNet, Profibus and SNMP.

D. The iCOM control processor shall be microprocessor based with a 320x240 dot matrix graphic front monitor display and control keys for user inputs mounted in an ergonomic, esthetically pleasing housing. The display & housing shall be viewable while the unit panels are open or closed. The controls shall be menu driven. The display shall be organized into three main sections: User Menus, Service Menus and Advanced Menus. The system shall display user menus for: active alarms, event log, graphic data, unit view/status overview (including the monitoring of room conditions, operational status in percent of each function, date and time), total run hours, various sensors, display setup and service contacts. A password shall be required to make system changes within the service menus. Service menus shall include: setpoints, standby settings (lead/lag), timers/sleep mode, alarm setup, sensor calibration, maintenance/wellness settings, options setup, system/network setup, auxiliary boards and diagnostics/service mode. A password shall be required to access the advanced menus which include the factory settings and password menus.

E. The iCOM control shall be factory wired to the indoor unit's low-voltage control panel. Wiring shall include enough length of cables to allow the control's display to be unlatched from the panel-mounted cradle/bezel assembly, and hand-held during service or hung on the Display Service Bracket. The back of the display shall have keyholes which align with studs on the Bracket, for a secure fit.

F. The User Menus Shall be Defined as Follows:

1. Active Alarms: Unit memory shall hold the 200 most recent alarms with time and date stamp for each alarm.
2. Event Log: Unit memory shall hold the 400 most recent events with id number, time and date stamp for each event.
3. Graphic Data View: Eight graphic records shall be available: return air temperature, return air humidity, supply air temperature, outdoor temperature and four custom graphs.
4. Unit View - Status Overview: Simple or Graphical "Unit View" summary displays shall include temperature and humidity values, active functions (and percent of operation) and any alarms of the host unit.
5. Total Run Hours: Menu shall display accumulative component operating hours for major components including compressors, Econ-O-Coil (FC), fan motor, humidifier and reheat.
6. Various Sensors: Menu shall allow setup and display of optional custom sensors. The control shall include four customer accessible analog inputs for sensors provided by others. The analog inputs shall accept a 4 to 20 mA signal. The user shall be able to change the input to 0 to 5VDC or 0 to 10VDC if desired. The gains for each analog input shall be programmable from the front display. The analog inputs shall be able to be monitored from the front display.

G. Display Setup: Customer shall pre-select the desired grouping of display languages at the time of the order from the following choices:
   1. Group 1: English, French, Italian, Spanish, German
   2. Group 2: English, Russian, Greek
   3. Group 3: English, Japanese, Chinese, Arabic

H. Service Contacts: Menu shall allow display of local service contact name and phone number.

I. The Service Menus Shall be Defined as Follows:
   1. Setpoints: Menu shall allow setpoints within the following ranges*:
      a. Temperature Setpoint 65-85*F (18-29*C)*
      b. Temperature Sensitivity +1-10*F (0.6-5.6*C)
      c. Humidity Setpoint 20-80% RH*
      d. Humidity Sensitivity 1-30% RH
      e. High Temperature Alarm 35-90*F (2-32*C)
      f. Low Temperature Alarm 35-90*F (2-32*C)
      g. High Humidity Alarm 15-85% RH
      h. Low Humidity Alarm 15-85% RH
      i. * The microprocessor may be set within these ranges. However, the unit may not be able to control to extreme combinations of temperature and humidity.
   2. Standby Settings/Lead-Lag: Menu shall allow planned rotation or emergency rotation of operating and standby units.
   3. Timers/Sleep Mode: Menu shall allow various customer settings for turning on/off unit.
   4. Alarm Setup: Menu shall allow customer settings for alarm notification (audible/local/remote). The following alarms shall be available:
      a. High Temperature
      b. Low Temperature
      c. High Humidity
      d. Low Humidity
      e. Short Cycle
      f. Compressor Overload (Optional)
      g. Main Fan Overload (Optional)
      h. Humidifier Problem
      i. High Head Pressure
      j. Change Filter
      k. Loss of Air Flow
      l. Low Suction Pressure
      m. Loss of Power
      n. Custom Alarm (#1 to #4). Custom alarms are four customer-accessible alarm inputs to be indicated on the front panel. Custom alarms can be identified with prepared (programmed) alarm labels for the following frequently used inputs:
         1) Water Under Floor
         2) Smoke Detected
         3) Standby GC Pump On
         4) Loss of Water Flow
         5) Standby Unit On
   5. User-customized text can be entered for two of the four custom alarms. Each alarm (unit and custom) can be separately enabled or disabled, selected activate the common alarm and programmed for a time delay of 0 to 255 seconds.
   6. Audible Alarm: Annunciates any alarm that is enabled by the operator.

7. Common Alarm: Programmable to interface user-selected alarms with a remote alarm device.
8. Remote Monitoring: Alarms shall be communicated to the Liebert monitoring system with the following information: Date and time of occurrence, unit number and present temperature and humidity.
9. Sensor Calibration: Menu shall allow unit sensors to be calibrated with external sensors.
10. Maintenance/Wellness Settings: Menu shall allow reporting of potential component problems before they occur.
11. Options Setup: Menu shall provide operation settings for the installed components.
12. System/Network Setup: Menu shall allow Unit to Unit (U2U) communication and setup for teamwork modes of operation (up to 32 units).
13. Teamwork Modes of Operation - Saves energy by preventing operation of units in opposite modes multiple units.
14. Auxiliary Boards: Menu shall allow setup of optional expansion boards.
15. Diagnostics/Service Mode: The iCOM control shall be provided with self-diagnostics to aid in troubleshooting. The microcontroller board shall be diagnosed and reported as pass/not pass. Control inputs shall be indicated as on or off at the front display. Control outputs shall be able to be turned on or off from the front display without using jumpers or a service terminal. Each control output shall be indicated by an LED on a circuit board.

J. Advanced Menus:
1. Factory Settings: Configuration settings shall be factory-set based on the pre-defined component operation.
2. Change Passwords: Menu shall allow new passwords to be set or changed.

K. Features of the Large Graphic Display which are in addition to those on the Small Graphic Display:
1. System View - Status Overview: "System View" shall display a summary of operation for the total number of operating units within a Unit-to-Unit (U2U) configuration.
2. Spare Parts List: Menu shall include a list of critical spare parts, their quantity and respective part numbers.
3. Setup Assistant: Menu shall include an online manual "assistant" for guidance during initial setup and routine maintenance.
4. Unit Diary: Menu shall include a free field area within the unit memory where unit history may be stored for reference.

2.20 DISPLAY SERVICE BRACKET FOR MICROPROCESSOR

A. For each indoor unit’s microprocessor display, provide a shipped-loose Display Service Bracket. The bracket shall be steel, and designed to hang over the unit panel edge at the bottom of the unit’s upper front-panel area (low-voltage compartment). The bracket shall have studs that align with keyholes in the back of the microprocessor display.

B. When not in use, the bracket shall be stored in the Owner’s toolbox, not inside the electrical compartment.

2.21 NETWORK SWITCH ASSEMBLY

A. Liebert series vNSA, wall-mounted NEMA 1 painted steel enclosure with hinged cover and key-lockable latch. Provide 2 keys to the Owner.

B. Assembly is required to enable multiple indoor units to communicate and be controlled in lead-lag sequences by a master Liebert ICOM display. Provide the model and quantity of assemblies as required to interconnect the CRAC units on the project.

C. Provide one 8-port switch.

D. Each switch has eight 10/100 Mbps twisted pair RJ45 ports, allowing connection of Ethernet-ready devices to available ports. The switch supports Ethernet 10 Mbps and Fast Ethernet 100 Mbps using twisted-pair RJ45 ports, allowing connection of Ethernet-ready devices. The devices support switched Ethernet networks in accordance with IEEE standard 802.3.

E. Three automatic features - autonegotiation, autopolarity and autocrossing - allow the use of standard network cables (CAT5 or better) for connection to each port, rather than a special crossover cable. The switch detects and makes adjustments for the network's speed and transmission mode, polarity and transmit-and-receive pins.

F. Factory interconnecting wiring between switches, and from power supply to switches.

G. Internal universal power supply. Requires 120V/1ph/60Hz power service.

H. Ambient Operating Environment: 32 to 140°F (0 to 60°C); 0 to 95% RH, non-condensing.

2.22 LEAK DETECTION SYSTEM

A. Provide solid state water sensors under the raised floor.

B. Liebert Liqui-tect 460 Module: The LT460 consists of a metal enclosure with a hinged top door providing access to the internal circuit board for wiring termination and configuration of DIP switches. The LT460 will monitor up to 100 feet of connected LT500Y leak etection cable.

C. Liebert LT500Y Leak Detection Cable: The cable material and construction allow the cable to lie flat when used with hold-down clips. The LT500Y is plenum-rated and UL-listed for safe operation. Provide cables in lengths of 15 to 50 feet as required. Provide end terminators and hold-down clips (two clips required for each 6-8 ft. of cable). Unit manufacturer shall select cable lengths suitable for the indoor unit.

2.23 REMOTE MONITORING SYSTEM

A. Liebert Intellislot 485 series communications module. Provides Liebert SiteScan Web or building management systems monitoring and control of Liebert equipment.

B. The card delivers Modbus or Liebert's proprietary protocol via the RS-485 port.

C. Field-furnished 18 AWG stranded and shielded wiring provides a maximum 3000 ft. (915m) wiring length in RS-485 (Modbus) protocol, and 1000 ft. (300m) in RS-422 (IGM) protocol.

2.24 DAMPER CONTROL

A. Provide a dry contact and a relay in each indoor unit, to control a 2-position motorized damper.

B. Provide inputs to receive a signal from an auxiliary switch on the damper, and controls to delay indoor unit fan start until the damper is proved open.

C. Dampers and actuators shall be furnished under Division 23 Section “Instrumentation and Control for Mechanical Systems.”

PART 3 - EXECUTION

3.1 GENERAL

A. The work of this Part of this Section shall be provided by the Contractor.

3.2 EXAMINATION

A. Division 01 Section “Project Management and Coordination”: Verification of existing conditions prior to beginning work.

B. Verify that flooring system is ready to receive work and opening dimensions are as indicated on Submittals and instructed by the manufacturer.

C. Verify that electric power is available and of the correct characteristics.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Coordinate installation of air conditioning unit with computer room raised floor installer.

C. Sequence the installation in coordination with other trades, with the structural roof grillage installation, with the provision of temporary “spot cooling”, and with the removal of the existing CRAC indoor and outdoor units. Minimize the length of time that the spot cooling is required, and minimize the length of time of unprotected penetrations in the security enclosure around the computer room.

D. Provide adequate drainage connections for water piping, condensate and humidifier flushing system.

E. Bolt indoor units to floor stand or floor slab as applicable, using a hex-head galvanized steel bolt with washers in each factory-furnished mounting hole. Fasten raised floor stands to floor slab.

F. Bolt outdoor units to supports, such as roof rails, steel grillage, and concrete pads, using a hex-head galvanized steel anchor bolt with washer in each factory-furnished mounting hole. Prevent contact between dissimilar metals.

G. Clean inside the units, drain pans, and humidifier pans.

H. Install filters before operating indoor unit fans.

I. Do not operate fans until dirty work of construction is completed.

J. Startup shall include verification of refrigerant charge, testing for leaks, and additional refrigerant and oil as required.

K. Provide field-furnished power, low-voltage, and communication wiring and conduits as required.

L. Install remote-mounted devices such as leak detection sensors and network switch assembly. Provide mounting accessories and interconnecting wiring as required.

3.4 MANUFACTURER'S FIELD SERVICES

A. Manufacturer’s field services will be furnished as part of the Owner’s prepurchase of the units. The Contractor shall provide support to the Manufacturer’s field representatives and technicians as required, and submit copies of the reports to the Architect.

B. Prepare and start systems under provisions of Division 01.

B. Set initial temperature and humidity set points. Instruct operating personnel.

END OF SECTION 238123

SECTION 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 Alterations.

C. Access Panels: Where required by NFPA 70 (N.E.C.)

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 OWNER FURNISHED PRODUCTS

A. Products Furnished to The Site And Paid For By Owner:
   1. Engine Generator Set As Specified Under Section 260622.
   2. Static Uninterruptible System As Specified Under Section 260611.
   3. Provide all interconnecting wiring and make all final connections. Coordinate with the Owner (USM) for specific requirements.
   4. Receive delivery, store, protect, handle and place at location indicated on the drawing.

1.5 SUBSTITUTIONS

A. Refer to Division 01 Section “Substitutions and Product Options”.

1.6 ALLOWANCES

A. Cash Allowance: Refer to Division 01.

1.7 ALTERNATES

A. Refer to Division 01.

B. Coordinate related work and modify surrounding work as required.

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.

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. 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. Provide number of junction boxes as required to allow for the wring indicated. Wiring from fixture to fixture is not allowed.
   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.
   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 Div. 01.

B. Arrange to execute the work at such times and in such locations as may be required to provide uninterrupted services for the building, or any of its sections or portions of the Campus.
   1. Services Include but Not Limited to: Power, lighting, fire alarm, paging/intercom, telephone,

computer, and life safety systems as required to maintain occupancy.

2. If necessary, install temporary work to provide for this condition. Authorization for interrupting services shall be obtained, in writing, from the Owner.
3. Costs for overtime work and temporary work shall be included in the bid.

PART 2 - PRODUCTS

2.1 PAINTING

A. Refer to Div. 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 4 and 9.

B. Standard panels: 12" x 16" except as indicated. Doors: flush type 14-gauge steel, hinged to 16-gauge frame. Latch: Flush face screw. 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 Section 260510 - 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”.

END OF SECTION 260010

SECTION 260111 – CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Metal Conduit.

B. Flexible Metal Conduit.

C. Liquid-tight Flexible Metal Conduit.

D. Electrical Metallic Tubing (EMT).

E. Fittings and Conduit Bodies.

1.2 RELATED SECTIONS

A. 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 bonding conductors specified.

1.5 SUBMITTAL PROCEDURES

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

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 Section “Project Management and Coordination”.

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 1/2 inch conduit.

B. Interior Wet and Damp Locations: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit.

C. 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.”

D. Panel Feeders: Use rigid galvanized steel and aluminum conduit, intermediate metal conduit, electrical metallic tubing in accordance with locations herein specified.

E. 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.

F. Couplings and connectors for rigid and intermediate metal conduit shall be threaded.

G. Termination for all conduit and tubing shall have insulated bushings or insulated throat connectors in accordance with code requirements.

H. 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 1/2" 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. Maintain adequate clearance between conduit and piping.

M. Maintain 6 inch clearance between conduit and surfaces with temperatures exceeding 104EF.

N. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.

O. 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.

P. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

Q. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic, control and expansion joints.

R. Provide suitable labeled nylon pull string in each empty conduit.

S. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

T. Use sleeves when passing through floors and walls.

U. When serving roof top equipment, conduit shall enter within the weather-proof curbing. Maintain water tight roofing system.

V. Ground and bond conduit under provisions of Division 26 Section “Grounding and Bonding.”

W. Identify conduit under provisions of Division 26 Section “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. Wireways.

1.2 RELATED WORK

A. Division 26 Section "Basic Electrical Requirements."

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 SUBMITTAL PROCEDURES

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 Division 01 Section "Substitutions and Product Options".

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: Ivory enamel.

D. Fittings, Boxes and Extension Rings, Couplings, Elbows, and Connectors: Furnish manufacturer's standard accessories for a complete installation.

2.2 WIREWAYS

A. Acceptable Manufacturers:
1. Cutler Hammer.
2. General Electric.
3. Square D.
4. Siemen.

B. Description: U.L. approved narrow sheet metal enclosure, rectangular in cross section, hinged 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.

D. Size: As required by NEC for the number and size wires indicated. Minimum 4 x 4 inches.

E. Cover: Hinged 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Exposed wiring shall not be installed in finished areas except where access within the wall and ceilings is not possible and as specifically indicated. Obtain approval from USM and the Architect prior to installing surface wiring.

B. Install products in accordance with manufacturer's instructions.

C. Use suitable insulating bushings and inserts at connections to outlets and corner fittings.

D. Maintain grounding continuity between raceway components to provide a continuous grounding path. Ground and bond under provisions of Division 26 Section "Grounding and Bonding."

E. 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.

C. Wiring connectors and connections.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

B. Division 26 Section “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. Unless Indicated Otherwise, Conductor Sizes Shown Are Based on Copper:
1. If aluminum option for conductors No. 4 AWG and larger is chosen increase the conductor size to have the same ampacity and same or less impedance as the copper size indicated; increase the conduit and pull box sizes to accommodate the larger size aluminum conductors in accordance with NFPA 70; assure that the pulling tension rating of the aluminum conductor is sufficient; relocate equipment, modify equipment terminations, re-size equipment, and resolve to the satisfaction of the Architect all problems that are the results of the use of aluminum conductors in lieu of copper.
2. Equipment Manufacturer Requirements: Where equipment is provided whose manufacturer requires copper conductors at the terminations, or requires that only copper conductors be provided between components of equipment, provide copper conductors, or all necessary splices, splice boxes, and other work required to satisfy manufacturer's requirements.

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 bending radius.

C. Include the following only if aluminum wire option is used: Indicate type, size, length, ampacity and impedance comparisons, termination methods and locations used. Comparison shall be in chart form listed by feeder/pnl name with all data CU vs AL for each feeder length.

D. Not submitting aluminum wire for approval is confirmation that only copper wiring will be used.

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. American Insulated Wire Corp.

B. Alcan Cable

C. Carol Cable.

D. The Okonite Co.

E. Pirelli.

F. Superior Essex Inc.

G. Triangle PWC, Inc.

H. Southwire Company.

2.2 WIRE AND CABLE

A. Description: Single conductor insulated wire.

B. Conductors: Sizes #6 AWG and Smaller: Copper. Sizes #4 AWG and larger: Copper or aluminum unless the type of conductor material is specifically indicated, specified, or required by equipment manufacturer.

C. Aluminum Conductors: Aluminum alloy that is listed by Underwriters' Laboratories, Inc. Standard 486B, marked "AL9CU" for 90EC. rated circuits and shall be equal to Annealed Stabiloy compact stranded (Aluminum Association 8000 series aluminum alloy) as manufactured by Alcan Cable - Atlanta, GA.

D. Insulation Voltage Rating: 600 volts.

E. Insulation: ANSI/NFPA 70 (N.E.C.), Type THW, 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: 90EC.

E. Armor Material: Steel or Aluminum.

F. Armor Design: Interlocked Metal Armor or Corrugated tube

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.

2.5 NONMETALLIC-SHEATHED CABLE - Not Allowed.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that mechanical and other 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 or XHHW insulation, in raceway or metal clad cable.

B. Accessible Dry Interior Locations (such as above acoustical ceilings): Use only wire Type THHN/THWN or 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 or XHHW insulation, in raceway.

D. Wet or Damp Interior Locations: Use only building wire Type THWN, XHHW, XHHW-2 insulation, in raceway.

E. Panel and Transformer Feeders: Use only building wire Type XHHW and XHHW-2 insulation, in raceway.

F. 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 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.

T. Splices Involving Aluminum Conductors:
1. Make with solderless circumferential compression type, aluminum bodied connectors UL listed for AL/CU. Remove all surface oxides from aluminum conductors by wire brushing and immediately apply an oxide inhibiting joint compound and insert in connector. After joint is made, wipe away excess joint compound and insulate splice.
2. Terminate aluminum conductors to copper bus by utilizing a circumferential compression type, aluminum bodied terminal lug UL listed for AL/CU, and steel Belleville spring washers, flat washers, bolts, and nuts. Belleville spring washers shall be of cadmium-plated hardened steel. Take care to install the Belleville spring washers with the crown up toward the nut or bolt head, with the concave side of the Belleville bearing on a heavy-duty, wide series flat washer of larger diameter than the Belleville. Tighten nuts sufficiently to flatten Belleville and leave in that position. Lubricate all hardware with joint compound prior to

making connection. Wire brush and apply joint compound to conductor prior to inserting in lug.

3. Terminate aluminum conductors to aluminum bus by utilizing all aluminum nuts, bolts, washers, and compression lugs. Wire brush and apply joint compound to conductor prior to inserting in lug. Lubricate all hardware with joint compound prior to making connection; if bus contact surface is unplated, scratch-brush and coat with joint compound (without grit).

3.5 INTERFACE WITH OTHER PRODUCTS

A. Identify wire and cable under provisions of Division 26 Section "Electrical Identification."

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 26 Section “Basic Electrical Requirements.”

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 Section “Submittal Procedures”.

B. Include product data for floor boxes, boxes larger than 12x12x6 inches, boxes with hinged covers.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01 Section “Project Management and Coordination.”

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.

D. Covers for flush floor devices shall meet UL scrub water standards for installation in carpet and tile

floors.

1.7 PROJECT CONDITIONS

A. Verify field measurements are as shown on Drawings.

B. Verify locations of all wall boxes 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 2-1/2 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 FD deep aluminum or cast feralloy.
   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 2-1/2 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; 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 Division 07.

G. Align Wall Boxes 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 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. 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. Coordinate mounting heights and locations of outlets mounted above counters, benches and backsplashes.

C. Position outlet boxes to locate luminaires as shown on reflected ceiling plan.

3.3 ADJUSTING

A. Adjust floor box flush with finish flooring material.

END OF SECTION 260130

SECTION 260141 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Wall Switches.

B. Receptacles.

C. Device Plates.

D. Lighting Occupancy Sensors.

E. Relays and Contactors.

F. Timeclocks.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements.”

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. Isolated Ground Duplex Receptacles, Rated 20Amp
   1. Hubbell, Model IG5362I
   2. Equal by Leviton, Cooper, or Pass & Seynour

C. 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; GFR5252
   3. Pass & Seymour; 2084

C. Device Body:
   1. Wall mounted devices shall be Ivory.
   2. Ceiling mounted devices shall be white.
   3. Stage mounted devices shall be black.

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 with stage mounted devices black.

E. Pilot Light: Neon type #1720-120v red. Separate gang position combined under same plate as switch or separately mounted.

F. Mushroom Panic Switches: Similar to Allen Bradley Series 800T-D6A, 1 N.O. & 1 N.C. momentary contacts mounted on flush stainless steel faceplate with appropriate flush backbox.
   1. Pushbutton Mushroom cylinder lock: Similar to Allen Bradley Series 800T-E15M6A plus button guard. Button shall lock when depressed and release only with key. Key removable in any position. Mount on flush stainless steel faceplate with appropriate flush backbox.
   2. Locate one Pushbutton cylinder lock at room door, ahead of Mushroom Panic Switches to allow instructor to lock out the room power.

2.5 LIGHTING OCCUPANCY SENSORS

A. Manufacturers:
   1. The Watt Stopper: Model numbers listed except as noted.
   2. Lightolier
   3. Light-O-Matic
   4. Sensor Switch
   5. Hubbell
   6. Leviton

B. Complete with Faceplates, Color: Ivory

C. Occupancy Sensor – Ceiling mounted: DT-300-Ivory dual technology ceiling mounted sensor
   1. 24 VDC/VAC and halfwave rectified AC
   2. Ultrasonic frequency of 40kHz
   3. Time delays: SmartSet (automatic) and fixed (5, 10, 15, 20, or 30 minutes), walk-through, test-mode. Set units for 15 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 (DT-300) works from 10 to 300 footcandles
   6. Low voltage, momentary switch input for manual operation
   7. DT-300 contains an isolated relay with N/O and N/C outputs; rated for 1 Amp @ 30 VDC/VAC
   8. Multi-level, 360° Fresnel lens for superior occupancy detection

9. Units per power pack: DT-300: up to 2 (B), up to 3 (BZ); DT-305: up to 3 (B), up to 4 (BZ)
10. Dimensions: 4.50" diameter x 1.02 deep (114.3mm x 25.91mm)
11. Typical PIR Coverage: 1000 sq.ft.
12. Typical Ultrasonic Coverage: 800-1200 sq.ft.
13. UL and CUL listed; Five year warranty
14. Provide power packs, mounting brackets and other hardware as required for a complete working system to cover the areas indicated.

D. Provide detailed wiring diagrams with submittals.

E. Occupancy Sensor Wall Switch: Leviton; OSSMT-MDODS 10-ID.
1. Description: Dual-Technology Decora Style Wall Switch Occupancy Sensor, compatible with incandescent lamps, low-voltage lighting with electronic and magnetic transformers, and electronic and magnetic fluorescent ballasts.
2. Integral manual push button ON/OFF override switch.
   a. If lights are OFF: Pressing button turns lights ON as long as the room stays occupied.
   b. If lights are ON: Pressing button turns lights OFF and stays OFF as long as the room stays occupied.
   c. The unit shall return to normal operation if it does not detect motion during the delay time interval.
3. Field of View:
   a. Passive Infra-Red (PIR): 180 Deg. Approximately 1200 square feet and 40 feet front view, 30 feet side to side. Adjustable with internal blinders from 180 to 32 Deg.
   b. Ultrasonic (US): Approximately 20 feet by 20 feet. Adjustable to Low Medium High sensitivity.
4. Features and Settings:
   a. Manual-ON/ Auto-OFF Feature: Set initially to Auto-ON/OFF.
   b. Ambient Light Recognition: Set initially to disable this feature.
   c. Delayed-OFF feature: Adjustable 10, 20, 30 minutes. Set initially to 20 minutes.
   d. Walk Through Sensing: (Momentary Occupancy). Overrides the set Delayed-OFF feature and turns lights OFF if unit does not detect activity for the first 2.5 minute.
5. Ratings:
   a. Input Voltage: 120/277 VAC.
   b. US: 40kHz.
   c. Load:
      1) Incandescent/Tungsten: 800W @ 120V
      2) Fluorescent: 1200VA @ 120V and 2700VA @ 277V
   d. Motor: 1/4 HP @ 120V
6. True Zero-Cross Relay: Switches at the zero crossing point of the AC power curve.
7. Designed to fit in a standard single gang wall box.
8. Designed to operate as a three way switch when two units are interconnected.
9. Color shall be Ivory.

F. Provide detailed wiring diagrams with submittals.

2.6 WALL PLATES

A. Decorative Cover Plate:
   1. Wall mounted Plates shall be Ivory smooth face nylon.
   2. Ceiling mounted Plates shall be white 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.

2.7 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. Lighting Relays/ Contactors used to bypass switches: LC&D GR 2001 E/S Emergency/Shunt Series.
   1. 120 volt and 277 volt coil as required.
   2. Single pole wired in parallel with wall switch..
   3. Minimum continuous ampere rating: 20 amps up to 277 volts.
   4. Rated for 40,000 operations @ 20A, 277 volts.
   5. Enclosure: NEMA-1, standard 4"x 4"x 2 1/4" junction box.
   6. Electrically held, except as noted.
   7. ETL listed to UL STD 916 and UL 924.

E. 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.

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 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. Division 26 Section “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. (N.E.C.), except that the Minimum System Resistance shall be 5 ohms (for electronic equipment).

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures.”

B. Product Data: Provide data for grounding electrodes and connections.

C. Test Reports: Indicate overall resistance to ground.

D. Manufacturer's Instructions: Include instructions for protection, examination, preparation and installation of exothermic connectors.

1.6 GROUNDING ELECTRODE SYSTEM

A. Existing System: Connect and extend as indicated and required by code.

1.7 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 MECHANICAL CONNECTORS

A. Material: Bronze.

2.2 EXOTHERMIC CONNECTIONS

A. Manufacturers:
1. Cadweld.
2. Thermoweld

2.3 WIRE

A. Material: Copper.

B. Grounding Electrode Conductor: Size to meet NFPA 70 requirements, but not smaller than indicated.

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 bonding conductor to each item of electrical equipment.

D. 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.

E. Provide grounding system for neutrals of dry type transformer secondaries as indicated and required.

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, Including but Not Limited to: Exhaust fans, air handling units, air-conditioning units, circulators, heating system pumps, engine generator set, Static Uninterruptable System (UPS) and associated Maintenance Bypass Cabinet (MBC).

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 Control for Mechanical 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, 1pole spare breaker. Label and show on as-built drawings.

1.2 RELATED SECTIONS

A. Division 23.

B. 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”.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Specified under Division 26 Section "Disconnect Switches."

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 PREPARATION

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 Division 26 Section "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. Provide matching receptacle for each cord and plug.

F. Make wiring connections in wiring compartment of prewired equipment in accordance with manufacturer's instructions.

G. 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. Division 26 Section "Basic Electrical Requirements."

1.3 REFERENCES

A. NFPA 70 (N.E.C.) Latest Edition.

1.4 REQUIREMENTS

A. Label all panelboards plus circuits on all spaces of switchboards and distribution panels, all safety switches, controls, relays, junction boxes, pull boxes, pilot lights, special switches and outlets. Label all modifications made to existing panels.

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. 210, Color code for branch circuits.

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.

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.

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. Insulated Isolated Grounding Conductor: Green with yellow stripe.
   3. Phase Conductors of 120/208 Volt System: Black, red, blue. Neutral: white.
   4. Phase Conductors of 277/480 Volt System: Brown, orange and yellow. Neutral: Gray

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, and at Load Connection: Provide wire markers on each conductor and Identify with branch circuit or feeder number.

E. Conductors of different system voltages shall not enter the same raceway, box, gutter, or other types of enclosures.

F. System Control Wires at Control Panel and Load Connection:
   1. Provide wire markers on each conductor and identify with number as indicated on equipment manufacturer's Shop Drawings.

END OF SECTION 260195

SECTION 260440 - DISCONNECT SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Disconnect Switches.

B. Fuses.

C. Enclosures.

1.2 RELATED SECTIONS

A. Division 26 Section “Basic Electrical Requirements”.

B. Division 26 Section “Equipment Wiring”.

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. Size per N.E.C. and Equipment Manufacturers' Recommendations.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures.”

B. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, horsepower, and short circuit.

1.6 SPARE PARTS

A. Fuses: Furnish to Owner three (3) spare fuses for each circuit and each device requiring fuses. Maximum of six (6) spare fuses of each type and rating installed.

B. Fuse Pullers: Furnish one fuse puller to Owner.

PART 2 - PRODUCTS

2.1 DISCONNECT SWITCHES

A. Acceptable Manufacturers:
   1. Cutler Hammer.
   2. I-T-E Siemens.
   3. General Electric.
   4. Square D.

B. Fusible Switch Assemblies: Heavy-duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position. Fuse Clips: Designed to accommodate Class R fuses.

C. Nonfusible Switch Assemblies: Heavy-duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position.

D. Rated: Horsepower rated, 600-volt and 250-volt as required by the particular circuit with ampere rating and number of poles as indicated, or as required by the specific equipment.

E. Enclosures: NEMA KS 1; Type 1 for interior dry locations, Type 3R raintight for exterior locations. Type 4 gasketed for wash down areas in kitchens.

2.2 FUSES

A. Acceptable Manufacturers:
   1. Bussman.
   2. Gould Shawmut.
   3. Littelfuse.

B. Fuses 600 Amperes and Less: Dual element time delay current limiting Class J; or Class RK5 (Dual Element Time Delay); 600volt and 250 volt as required by equipment.

C. Interrupting Rating: 200,000 RMS amperes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Division 26 Section “Equipment Wiring”.

B. Install fuses in fusible disconnect switches.

C. Mount fuse cabinet in main electrical room.

END OF SECTION 260440

SECTION 260461- DRY-TYPE TRANSFORMERS

PART 1 - GENERAL

1.1 WORK INCLUDES

A. Dry type two winding transformers.

1.2 RELATED WORK

A. Division 26 Section "Basic Electrical Requirements."

B. Division 26 Section "Grounding and Bonding."

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. Natural-draft, air cooled dry type transformers. Use of cooling fans not acceptable.

D. Size per Drawings.

1.5 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section "Submittal Procedures."

B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 25, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

C. Include details of support platforms on all transformers not floor mounted.

D. Include Letter from manufacturer that the product is available and will not be substituted with a product requiring cooling fans for full load output after Natural-draft, air cooled dry type transformers shop drawings have been approved.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cutler-Hammer.

B. General Electric.

C. Square D.

D. Hevi-Duty.

E. ITE-Siemens.

2.2 DRY TYPE TWO WINDING TRANSFORMERS

A. Dry Type Transformers: ANSI/NEMA ST 20; factory-assembled, natural-draft, air cooled dry type transformers, k factor rated for nonlinear loads; kVA ratings as shown on the Drawings. Transformers rated 150kVA and below for three-phase circuits shall be K-4, 50% nonlinear loads three-phase type rated for 480 volt delta primary and 120/208 volt, three-phase, four-wire wye secondary, except as noted. Transformers rated 225kVA and 300kVA for three-phase circuits shall be K-13, 100% nonlinear loads three-phase type rated for 480 volt delta primary and 120/208 volt, three-phase, four-wire wye secondary.

B. Provide electrostatic shield full height of winding between primary and secondary windings with separate insulated grounding connection.

C. Insulation System and Average Winding Temperature Rise As Follows:

Insulation Class	Temperature Rise (degree C)
220EC (total insulation system)	115

D. Case temperature shall not exceed 30EC rise above ambient at its warmest point.

E. Winding Taps: Two 2-1/2% above and below rated voltage on primary winding.

F. Sound Levels: NEMA TR-27. Maximum sound levels as follows:

KVA	Sound Rating Level
1-9	40 db
10-50	45 db
51-150	50 db
151-300	55 db
301-500	60 db
501-700	62 db

G. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

H. Mounting: Floor Mounted.

I. Coil Conductors: Continuous windings with terminations brazed or welded.

J. Enclosure: NEMA Type 1 Air-cooled with steel enclosures ventilated as required and provided with suitable terminal compartments and terminals designed to receive both copper and aluminum conductors.

K. Isolate core and coil from enclosure using vibration absorbing mounts to minimize noise transmission.

L. Nameplate: Include transformer connection data, rated KVA and voltage, insulation class, temperature rise, and overload capacity based on rated allowable temperature rise.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set transformer plumb and level. Ventilated transformers located against walls shall be located sufficient distance from wall for proper ventilation. Coordinate with manufacturer's recommendations and Code requirements.

B. Mount transformers on vibration isolating pads suitable for isolating the transformer noise from the building structure.

C. Use flexible conduit, 2 ft minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure. See manufacturer's drawings for allowable locations.

D. Secondary neutral of transformer shall be grounded to building steel and to grounding conductor from source and as required by NEC. Neutral conductor shall terminate on isolated neutral bus and grounding conductor shall terminate on ground bus in panel served.

E. Install cable lugs to transformer studs so that lug protrusion is facing away from front cover to maximize the distance from the lug to the cover.

3.2 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments.

3.3 TESTS

A. Test in accordance with current NEMA and ANSI Standards.

B. Field Verify Minimum Megger Readings of 1000 Megohms as Follows:
   1. Primary to ground.
   2. Secondary to ground.

END OF SECTION 260461

SECTION 260470 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting And Appliance Branch Circuit Panelboards.

B. Distribution Panelboards.

C. Individually Mounted Circuit Breakers.

D. Feeder Breaker for Existing SWBD.

E. Panel Mount Transient Suppression.

1.2 RELATED SECTIONS

A. Division 26 Section "Basic Electrical Requirements."

B. Division 26 Section "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.

D. TVSS minimum standards: IEEE C62.41& IEEE C62.45, NEMA LS 1, UL 1449, NEC 285. The TVSS shall be installed on the load side of overcurrent protective device unless provided with integral overcurrent protection. TVSS category C for service equipment; category B for branch panels; and category A when mounted at the load. The peak single-impulse ratings for non-modular assembly shall be 240KA, 160KA, or 120KAbased on category location. Provide where specified below.

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 arrangement, catalog, specification and sizes, panel dimensions, and gutter space.

C. Include Hazard Warning Label mounted on panel to confirm NFPA 70E.

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. Minimum 5 keys.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES - PANELBOARDS

A. General Electric.

B. Cutler-Hammer.

C. I-T-E Siemens.

D. Square D.

2.2 BRANCH CIRCUIT PANELBOARDS

A. Lighting and Appliance Branch Circuit Panelboards: 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 and 277/480 volt service as scheduled.

B. Enclosure: NEMA Type 1 except as noted. Code gauge galvanized steel boxes and enameled steel fronts sized for 6" nominal 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 subfeed and feed-through lugs as required. Lugs designed for use for both copper and aluminum conductors. Subfeed lugs shall mean tapped ahead of buses and feed-through shall mean tapped on load side of main and buses.

E. Neutral Bar: Full size insulated from the cabinet and provided with lugs for each branch circuit space in the panel.

F. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. (Provide as indicated on panelboard schedules – see drawings.)

G. Bonding strap securely attached to the cabinet with lugs as required to receive the bonding conductors indicated and specified.

H. Minimum Integrated Short Circuit Rating: minimum ratings shall be as follows:
   1. 10,000 amperes rms symmetrical at 240 volt for 120/208v panels served by a dry type transformer rated 225 KVA or less.
   2. 10,000 amperes rms symmetrical for 480 volt panelboards if down stream of a current limiting breaker.
   3. 14,000 amperes rms symmetrical for 480 volt panelboards.

I. 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 DISTRIBUTION PANELBOARDS (Greater Than 225A)

A. Panelboards:
   1. Circuit breaker type CDP with mains and circuits as indicated on the Drawings and designed for three phase, four wire, solid neutral, 60 cycle service rated for 120/208 volt and 277/480 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. Bus: Copper or aluminum ratings as scheduled on Drawings. Lugs designed for use for both copper and aluminum conductors.

D. Neutral Bar: Full size insulated from the cabinet and provided with lugs as required to receive the conductors indicated and specified.

E. Bonding strap securely attached to the cabinet with lugs as required to receive the bonding conductors indicated and specified.

F. Molded Case Circuit Breakers:
   1. Main and branch breakers shall have minimum interrupting rating of 14,000 AIC.
   2. Provide circuit breakers UL listed as Type HACR for air conditioning equipment branch circuits.

2.4 INDIVIDUALLY MOUNTED CIRCUIT BREAKERS

A. Molded Case Circuit Breakers: As specified above in item BRANCH CIRCUIT PANELBOARDS.

B. Enclosure: NEMA Type 1 general purpose except as noted.

C. Flush or surface mounted as indicated.

2.5 FEEDER BREAKER FOR EXISTING SWBD

A. New breaker installed in existing switchboard shall match frame size, manufacturer, and AIC of the existing breakers. Provide bus bars extension kits and cover plates for proper installation.

2.6 INTEGRAL- MOUNT TRANSIENT SURGE SUPPRESSORS

A. Provided as an integral part of the panelboards. Equal to GE Tranquell TVSS series and the following:

B. Rated Voltage Designed for Panel Served: 120/208 and 277/480 VAC 3 phase, 4 wire plus ground.

C. Suppression Response: ANSI/IEEE C62.41 Category A & B & C for locations served.

D. Suppression Voltage Ratings: UL Standard 1449.

E. EMI/RFI Noise Filtering: UL-1283.

F. 7 Mode Device: 3x L-N, 3x L-G, and N-G.

G. Branch panelboard equal to GE TME series,
1. Max Surge Current per phase/per mode: 130kA/65kA
2. Bus to Bus connected.
3. Integral combination thermal and surge rated fusing.
4. Audible alarm with test feature.
5. Surge counter.

H. Main & Distribution panelboard equal to GE THE series,
1. Max Surge Current per phase/per mode: 200kA/100kA
2. Factory installed to panelboard.
3. Integral surge rated disconnect and combination thermal and surge rated fuses.
4. Audible alarm with test feature.
5. Surge counter with adjustable sensitivity.
6. Green status and red service lights.
7. Contacts for remote monitoring.

I. Provide at the following panels: Panel BDP and panel DPU.

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. Finish painting of flush panelboards and individually mounted breakers shall be as specified in

Division 09 Section "Painting".

F. Properly support backboards, and panels. Coordinate with Division 06 Section "Rough Carpentry", to provide blocking as required.

G. Properly support backboards, and panels. At non structural walls and fire 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.

H. Provide Label on exterior of all panels served by the generator: AWarning Panel is Served by Two Sources (Emergency & Normal). Both Sources Shall Be Locked OFF Before Servicing.@

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.

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. Interior and luminaires and accessories.

B. Ballasts.

C. Lamps.

D. Additional wiring methods for luminaires.

1.2 RELATED SECTIONS

A. Division 26 Section "Basic Electrical Requirements."

1.3 REFERENCES

A. NEMA Standards.

B. NFPA 70 N.E.C. Latest Edition as adopted by the State of Maine.

C. U.L. Standards.

D. ANSI/NFPA 101 - Life Safety Code.

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.

1.5 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 - Luminaires: Provide dimensions, ratings, performance data, and total input watts.

D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.6 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.

1.7 SPARES

A. Provide one louver/guard.

B. Provide one plastic lens.

C. Provide replacement lamps for each lamp type installed as follows:
1. Minimum of 10 lamps for each type.

D. Provide replacement ballasts for each ballast type installed as follows:
1. Minimum of 2 ballasts for each type installed.

1.8 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 Division 26 Section "Basic Electrical Requirements."

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish products as specified on the 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:
1. Halo
2. Columbia
3. Cooper
4. Daybrite
5. Hubble
6. Lightolier
7. Litecontrol

8. Lithonia
9. Moldcast
10. Peerless

E. Ballast: Provide ballast suitable for lamp specified.

F. Luminaire disconnect: all luminaires shall incorporate a UL listed luminaire disconnect. Similar to Thomas & Betts Sta-Kon series LD2-D/LD3-D. (Female connector shall be wired to the line side and the male connected to the ballast.)

G. Lamps: All lamps shall be furnished and installed in each fixture.

2.2 BALLASTS: Rated universal voltage, or as noted.

A. Ballast Manufacturers:
1. Valmont.
2. Osram/Sylvania.
3. Universal Lighting Technologies, formerly Magnetek.
4. Jefferson.
5. Advance.

B. T8 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 programmed 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 AHigh Efficiency Schools@ by the State of Maine.

2.3 LAMPS

A. Lamp Manufacturers:
1. Sylvania/Osram.
2. Philips.
3. Venture Lighting International.
4. General Electric.

B. Fluorescent Lamps: T8 - High Lumen (3100 lumen), Energy saving 3500K, 85 CRI, designed to operate properly when driven by instant start electronic ballasts.

C. All lamps shall meet the TCLP tests for low mercury and non-hazardous for the purpose of disposal.

D. High Intensity Discharge Lamps: Supplied as indicated.

E. Provide lamp types specified for luminaire.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixtures: Complete with sockets, wiring, ballasts, stems, hangers, fittings, end plates, pendant feeds, 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. Provide pendant length required to suspend luminaire at indicated height. Cut or lengthened to give mounting heights as indicated and required.
      c. 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 at structure above each fixture.
      d. Except as specifically noted, fixtures shall be supported from the structure. Provide unistrut channels or equal to span between top cord of joists. Supports shall be suitable for fixture weight and seismic forces.
      e. 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 and surface mounted onto the ceiling grid of suspended acoustical ceilings. Hangers shall be independent of ceiling framing suspension system and shall extend 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 AT@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. 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 prohibit movement.

G. Install accessories furnished with each luminaire.

H. Additional Wiring Methods For Luminaires:
   1. Refer to Division 26 Section "Basic Electrical Requirements": Performance Requirements.
   2. Refer to Division 26 Section "Wire and Cable": Wiring Methods.
   3. 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.

I. Bond products and metal accessories to branch circuit equipment grounding conductor.

J. Install specified lamps in each luminaire.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Locate fixtures to avoid interference with mechanical and structural features.

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. Relamp luminaires whose lamps have failed at Substantial Completion.

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces using procedures as recommended by manufacturer.

E. Clean finishes and touch up damage.

END OF SECTION 260510

SECTION 260611 - STATIC UNINTERRUPTIBLE SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, and other applicable specification sections in the Project Manual apply to the work specified in this Section.

1.2 SECTION INCLUDES

A. The work specified in this Section includes, but shall not be limited to, a continuous duty, three-phase, solid state, on-line double conversion static UPS.
   1. The UPS shall utilize a rack-mounted N+1 redundant, scalable array architecture. The system power train shall be comprised of 10 kVA/10 kW power modules and shall be capable of being configured for N+X redundant operation at the rated system load. In systems operating at a load where the system is N+1 or greater, the UPS shall facilitate the replacement of power modules while the system remains in normal operation, without the requirement to transfer to bypass (trained personnel hot swappable).
   2. Each 10 kVA/10 kW power module shall contain a fully rated input rectifier/boost converter hereafter referred to as the input converter, a fully rated output inverter, and battery charging circuit. The system shall also be comprised of a trained personnel hot swappable continuous duty bypass static switch module, trained personnel hot swappable battery modules, redundant control modules, redundant logic power supplies, and LCD interface/display. All of the above system components shall be housed in standard 23.6” (600 mm) wide by 42” (1070 mm) deep by 78.8” (2000 mm) high enclosure.
   3. The UPS and associated equipment shall operate in conjunction with a primary power supply and an output distribution system to provide quality uninterrupted power for mission critical, electronic equipment load.
   4. All programming and miscellaneous components for a fully operational system as described in this Section shall be available as part of the UPS.

1.3 RELATED SECTIONS

A. Division 26 Section "Basic Electrical Requirements."

1.4 REFERENCES

A. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only. The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

B. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   1. ANSI/IEEE 519, "Guide for Harmonic Control and Reactive Compensation of Static Power Converters" (copyrighted by IEEE, ANSI approved).

C. International Organization for Standardization (ISO):

1. ISO 9001, "Quality Management Systems - Requirements."
2. ISO 14001, “Environmental Management Systems - Requirements With Guidance for Use.”

D. Underwriters Laboratories, Inc. (UL):
1. UL 1778 second Edition, "Standard for Uninterruptible Power Supply Equipment" (copyrighted by UL, ANSI approved).
2. UL 60950-1, “Standard for Information Technology Equipment.”

E. International Electrotechnical Commission (IEC)
1. IEC 61000-4-2, “Electromagnetic Compatibility - Testing and Measurement Techniques; Electrostatic Discharge Immunity Test.”
2. IEC 61000-4-3, “Electromagnetic Compatibility - Testing and Measurement Techniques; Radiated, Radio Frequency, Electromagnetic Field Immunity Test.”
3. IEC 61000-4-4, “Electromagnetic Compatibility - Testing and Measurement Techniques; Electrical Fast Transient/Burst Immunity Test.”
4. IEC 61000-4-5, “Electromagnetic Compatibility - Testing and Measurement Techniques; Surge Immunity Test.”
5. IEC 62040-2, “Uninterruptible Power Systems - Electromagnetic Compatibility (EMC) Requirements,”
6. IEC 62040-3, “Uninterruptible Power Systems - Method of Specifying the Performance and Test Requirements.”

F. CSA:
1. C22.2 no. 107.1-M95, “General Use Power Supplies.”
2. 60950-1, “Information Technology Equipment - Safety - Part 1: General Requirements.”

G. EMC:
1. FCC part 15 Class A.

1.5 SYSTEM DESCRIPTION

A. Design Requirements:
1. The UPS shall be sized for 60 kVA and 60 kW load, configured for “N+1” redundancy for a total of 6 + 1 Modules.
2. The UPS battery shall be sized for 60 kW at a power factor of 1 for 12 minutes.

B. System Characteristics:
1. System Capacity: The system shall be rated for full kW output in the following frame sizes:
   a. 100 kVA/kW, can be configured with up to ten, 10 kW power modules for 100 kW or 90 kW N+1.
2. Input: The system input shall be configurable as either single or dual mains derived from a three phase wye source. Standard cable entry shall be through the top. Bottom cable entry shall also be facilitated.
   a. AC Input Nominal Voltage: 208 Y/120 V three-phase, 4-wires plus ground, 60 Hz.
   b. AC Input Voltage Window:
      1) ±15 percent for full performance (177 to 239 volts).
   c. Short Circuit Withstand Rating: 30,000 symmetrical amperes.
   d. Maximum Frequency Range: 40 to 70 hertz.

e. Input Power Factor:
   1) Greater than 0.99 with load at 100 percent.
   2) Greater than 0.98 with loads above 50 percent.
   3) Greater than 0.95 with loads above 25 percent.
f. Input Current Distortion With No Additional Filters: Less than 5 percent at full load.
g. Soft-Start: Shall be linear from 0 percent to 100 percent input current and shall not exhibit inrush. This shall take place over a selectable 1 second to 60 second time period with a factory default of 10 seconds.

3. UPS Output:
   a. AC Output Nominal Output: 208 Y/120 V, 4-wires plus ground, 60 Hz.
   b. AC Output Voltage Distortion: Less than 2 percent at 100 percent linear load, less than 6.5 percent for non-linear load as defined by IEC/EN 62040-3.
   c. AC Output Voltage Regulation: ±1 percent for 100 percent linear or non-linear load.
   d. Voltage Transient Response: ±5 percent maximum RMS change in a half cycle at load step 0 percent to 100 percent or 100 percent to 0 percent.
   e. Voltage Transient Recovery: Within less than 50 milliseconds.
   f. Output Voltage Harmonic Distortion: Less than 2 percent THD maximum and 1 percent single harmonic for a 100 percent linear load.
   g. Overload Capabilities:
      1) Normal Operation:
         a) 150 percent for 30 seconds before transfer to bypass.
      2) Battery Operation: 150 percent for 30 seconds.
      3) Bypass Operation:
         a) 125 percent continuous at 208 volts.
         b) 1000 percent for 100 milliseconds.
   h. System Efficiency:
      1) Normal operation greater than 92.5 percent at 35 percent to 100 percent load.
      2) Battery operation greater than 92.5 percent at 35 percent to 100 percent load.
   i. Output Power Factor Rating: 0.5 leading to 0.5 lagging without any derating.

1.6 SUBMITTALS

A. Submit Shop Drawings, Owner's Manuals, and Operating Instructions in accordance with Division 01 Section “Submittal Procedures”.

B. Product Data: Submit product data showing material proposed. Submit sufficient information to determine compliance with the Drawings and Specifications. Product data shall include, but shall not be limited to, the following:
   1. As bid system bill of materials.
   2. Product catalog sheets or equipment brochures.
   3. Product guide specifications.

C. Shop Drawings: Submit shop drawings for each product and accessory required. Include information not fully detailed in manufacturer’s standard product data, including, but not limited to, the following:
   1. Installation information, including, but not limited to, weights and dimensions.
   2. Information about terminal locations for power and control connections.
   3. Drawings for requested optional accessories.

D. Wiring Diagrams: Submit wiring diagrams detailing power, signal, and control systems, clearly differentiating between manufacturer-installed wiring and field-installed wiring, and between components provided by the manufacturer and those provided by others.
   1. Submit system single-line operation diagram.

E. Operation and Maintenance Data: Submit operation and maintenance data including, but not limited to, safe and correct operation of UPS functions.
   1. Submit an installation manual, which shall include, but shall not be limited to, instructions for storage, handling, examination, preparation, installation, and start-up of UPS.
   2. Submit an operation and maintenance manual, which shall include, but shall not be limited to, operating instructions.

1.7 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: Manufacturer shall be a firm engaged in the manufacture of solid state UPS of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of 20 years.
      a. The manufacturer shall be ISO 9001 certified and shall be designed to internationally accepted standards.
   2. Installer Qualifications: Installer shall be a firm that shall have a minimum of five years of successful installation experience with projects utilizing solid state UPS similar in type and scope to that required for this Project.

B. Pre-Installation Conference: Prior to commencing the installation, meet at the Project site to review the material selections, installation procedures, and coordination with other trades. Pre-installation conference shall include, but shall not be limited to, the Contractor, the Installer, and any trade that requires coordination with the work. Date and time of the pre-installation conference shall be acceptable to the Owner (USM) and the Architect/Engineer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in supplier's or manufacturer's original wrappings and containers, labeled with supplier's or manufacturer's name, material or product brand name, and lot number, if any.

B. Store materials in their original, undamaged packages and containers, inside a well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1.9 PROJECT CONDITIONS

A. Environmental Requirements: Do not install the UPS until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
   1. Environmental:
      a. Storage Ambient Temperature: 5 °F (-15 °C) to 104 °F (40 °C).

b. Operating Ambient Temperature: 32 °F (0 °C) to 104 °F (40 °C) (77 °F [25 °C] shall be ideal for most battery types).
c. Relative Humidity: 0 percent to 95 percent non-condensing.
d. Audible Noise (As Measured 3 Feet 914 mm From Surface):
   1) 60 dBA at 70 percent load.
   2) 67 dBA at 100 percent load.

1.10 WARRANTY

A. Special Warranty: The Contractor shall warrant the work of this Section to be in accordance with the Contract Documents and free from faults and defects in materials and workmanship for period indicated below. This special warranty shall extend the one year period of limitations contained in the General Conditions. The special warranty shall be countersigned by the Installer and the manufacturer.
   1. The UPS shall be covered by a full parts and labor warranty from the manufacturer for a period of 12 months from date of installation or acceptance by the Owner or 18 months from date of shipment from the manufacturer, whichever occurs first.

B. Additional Owner Rights: The warranty 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.

1.11 MAINTENANCE

A. A complete offering of preventative and full service maintenance contracts for the UPS system and the battery system shall be available from the manufacturer. Contract work shall be performed by factory-trained service personnel.

B. Provide a price to the Owner for a one year full service maintenance contract for the full UPS system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Product specified is “APC Symmetra PX 100 kW” as manufactured by APC by Schneider Electric. Items specified are to establish a standard of quality for design, function, materials, and appearance. Equivalent products by other manufacturers may be submitted for approval. The Architect/Engineer and Owner will be the judge of the basis of what is equivalent.

2.2 MODES OF OPERATION

A. Normal: The Input converter and output inverter shall operate in an on-line manner to continuously regulate power to the critical load. The input and output converters shall be capable of full battery recharge while simultaneously providing regulated power to the load for all line and load conditions within the range of the UPS specifications.

B. Battery: Upon failure of the AC input source, the critical load shall continue being supplied by the output inverter, which shall derive its power from the battery system. There shall be no interruption in power to the critical load during both transfers to battery operation and retransfers from battery to normal operation.

C. Recharge: Upon restoration of utility power to the UPS input, the input converter and output inverter shall simultaneously recharge the battery and provide regulated power to the critical load.

D. Static Bypass: The static bypass shall be used to provide controller transfer of critical load from the inverter output to the bypass source. This transfer, along with its retransfer, shall take place with no power interruption to the critical load. In the event of an emergency, this transfer shall be an automatic function.

E. Maintenance Bypass: The system shall be equipped with an external make-before-break maintenance bypass cabinet (MBC) to electrically isolate the UPS during routine maintenance and service of the UPS. The MBC shall allow for the completely electrical isolation of the UPS.

2.3 INPUT CONVERTER

A. General: The Input converters of the system shall be housed within the removable power modules, and shall constantly control the power imported from the mains input of the system, to provide the necessary UPS power for precise regulation of the DC bus voltage, battery charging, and main inverter regulated output power. These power modules shall be connected in parallel within the UPS frame.

B. Input Current Total Harmonic Distortion: The input current THDI shall be held to less than 5 percent at full system load, while providing conditioned power to the critical load bus, and charging the batteries under steady-state operating conditions. This shall be true while supporting both a linear or non-linear load. This shall be accomplished without the requirement for additional filters, magnetic devices, or other components.

C. Soft-Start Operation: As a standard feature, the UPS shall contain a user-adjustable soft-start, capable of limiting the input current from 0 percent to 100 percent of the nominal input over a default 10 second period, when returning to the AC utility source from battery operation. The change in current over the change in time shall take place in a linear manner throughout the entire operation.

D. Magnetization Inrush Current: The UPS shall exhibit zero inrush current as a standard product.

E. Input Current Limit:
   1. The Input converter shall control and limit the input current draw from utility to 150 percent of the UPS output. During conditions where input current limit is active, the UPS shall be able to support 100 percent load, charge batteries at 10 percent of the UPS output rating, and provide voltage regulation with mains deviation +15/-5 percent.
   2. In cases where the source voltage to the UPS is nominal and the applied UPS load is equal to or less than 100 percent of UPS capacity, input current shall not exceed 125 percent of UPS output current, while providing full battery recharge power and importing necessary power to account for system losses.

F. Redundancy: The UPS shall be capable of being configured with redundant Input converters, each with semiconductor fusing, and logic-controlled contactors to isolate a failed module from the input bus.

G. Back-Feed Protection: The above mentioned logic-controlled contactor shall also provide the back-feed protection required by UL 1778, CSA 22.2, and IEC/EN Standards.

H. Charging:
1. The battery charging shall keep the DC bus float voltage of ±218 volts, ±1 percent.
2. The battery charging circuit shall contain a temperature compensation circuit, which shall regulate the battery charging to optimize battery life.
3. The battery charging circuit shall remain active when in static bypass and in normal operation.
4. Maximum charging power: 10% of output power rating or a maximum charge current of 0.25 CA.

2.4 OUTPUT INVERTER

A. General: The UPS output inverter shall constantly develop the UPS output voltage waveform by converting the DC bus voltage to AC voltage through a set of IGBT driven power converters. In both normal operation and battery operation, the output inverters shall create an output voltage independent of the mains input voltage. Input voltage anomalies such as brown-outs, spikes, surges, sags, and outages shall not affect the amplitude or sinusoidal nature of the output voltage sine wave of the inverters.

B. Overload Capability: Steady-state overload conditions, of up to 150 percent of system capacity shall be sustained by the inverter for 30 seconds in normal and battery operation. Should overloads persist past the outlined time limitation, the critical load shall be switched to the automatic static bypass output of the UPS.

C. Output Contactor: The output inverter shall be provided with an output mechanical contactor to provide physical isolation of the inverter from the critical bus. With this feature a failed inverter shall be isolated from the critical bus.

D. Battery Protection: The inverter shall be provided with monitoring and control circuits to limit the level of discharge on the battery system.

E. Redundancy: The UPS shall be capable of being configured with redundant output inverters, each with semiconductor fusing, and logic-controlled contactors to remove a failed component from the input, DC, and output critical bus.

2.5 STATIC BYPASS

A. General: As part of the UPS, a system static bypass cabinet shall be provided. The system static bypass shall provide no break transfer of the critical load from the inverter output to the static bypass input source during times where maintenance is required, or the inverter can not support the critical bus. Such times may be due to prolonged or severe overloads, or UPS failure. The UPS and static bypass switch shall constantly monitor the auxiliary contacts of their respective circuit breakers, as well as the bypass source voltage, and inhibit potentially unsuccessful transfers to static bypass from taking place.

B. Design: The design of the static switch power path shall consist of silicon-controlled rectifiers (SCR) with a continuous duty rating of 125 percent of the UPS output rating.

C. Automatic Transfers: An automatic transfer of load to static bypass shall take place whenever the load on the critical bus exceeds the overload rating of the UPS. Automatic transfers of the critical load from static bypass back to normal operation shall take place when the overload condition is removed from the critical output bus of the system. Automatic transfers of load to static bypass shall also take place if for any reason the UPS cannot support the critical bus.

D. Manual Transfers: Manually initiated transfers to and from static bypass shall be initiated through the UPS display interface.

E. Overloads: The static bypass shall be capable of handling overloads equal to or less than 125 percent of the rated system output continuously. For instantaneous overloads caused by inrush current from magnetic devices, or short circuit conditions, the static bypass shall be capable of sustaining overloads of 1000 percent of system capacity for periods of up to 100 milliseconds.

F. Modular: The static bypass switch shall be of a modular design.

G. System Protection: As a requirement of UL 1778, back-feed protection in the static bypass circuit shall also be incorporated in the system design. To achieve back-feed protection, a mechanical contactor in series with the bypass SCR(s) shall be controlled by the UPS/static switch, to open immediately upon sensing a condition where back-feeding of the static switch by any source connected to the critical output bus of the system is occurring. One such condition could be a result of a shorted SCR.

2.6 DISPLAY AND CONTROLS

A. Control Logic: The UPS shall be controlled by two fully redundant, trained personnel hot-swappable intelligence modules (IM). These modules shall have separate, optically isolated, communication paths to the power and static switch modules. Logic power for the control modules shall be derived from redundant power supplies, each having a separate AC and DC input and output. The communication of the control modules shall be of controller area network (CAN Bus).

B. Display unit: A microprocessor-controlled display unit shall be located on a hinged door in front of the system. The display shall consist of an alphanumeric display with backlight, four LEDs for quick status overview, and a keypad consisting of pushbutton switches.

C. Metered Data: The following data shall be available on the alphanumeric display:
1. Year, month, day, hour, minute, second of occurring events.
2. Source input voltage.
3. Output AC voltage.
4. Output AC current.
5. Input frequency.
6. Battery voltage.

D. Event Log: The display unit shall allow trained personnel to display a time and date stamped log.

E. Alarms: The display unit shall allow the Owner to display a log of active alarms. The following minimum set of alarm conditions shall be available:

1. Input frequency outside configured range.
2. AC adequate for UPS but not for bypass.
3. Low/no AC input, startup on battery.
4. Intelligence module inserted.
5. Intelligence module removed.
6. Redundant intelligence module inserted.
7. Redundant intelligence module removed.
8. Number of batteries changed since last on.
9. Number of power modules changed since last on.
10. Number of batteries increased.
11. Number of batteries decreased.
12. Number of power modules increased.
13. Number of power modules decreased.
14. Number of external battery cabinets increased.
15. Number of external battery cabinets decreased.
16. Redundancy restored.
17. Need battery replacement.
18. The redundant intelligence module is in control.
19. UPS fault.
20. On battery.
21. Shutdown or unable to transfer to battery due to overload.
22. Load shutdown from bypass. input frequency, volts outside limits.
23. Fault, internal temperature exceeded system normal limits.
24. Input circuit breaker open.
25. System level fan failed.
26. Bad battery module.
27. Bad power module.
28. Intelligence module installed and failed.
29. Redundant intelligence module installed and failed.
30. Redundancy lost.
31. Redundancy below alarm threshold.
32. Runtime below alarm threshold.
33. Load above alarm threshold.
34. Load no longer above alarm threshold.
35. Minimum runtime restored.
36. Bypass not in range (either frequency or voltage).
37. Back-feed contactor stuck in OFF position.
38. Back-feed contactor stuck in ON position.
39. UPS in bypass due to internal fault.
40. UPS in bypass due to overload.
41. System in forced bypass.
42. Fault, bypass relay malfunction.
43. High DC warning.
44. High DC shutdown.
45. Low battery shutdown.
46. Low battery warning.

F. Controls: The following controls or programming functions shall be accomplished by the use of the display unit. Pushbutton membrane switches shall facilitate these operations:
   1. Silence audible alarm.
   2. Display or set the date and time.
   3. Enable or disable the automatic restart feature.
   4. Transfer critical load to and from static bypass.
   5. Test battery condition on demand.
   6. Set intervals for automatic battery tests.
   7. Adjust set points for different alarms.
   8. Program the parameters for remote shutdown.

G. Potential Free (Dry) Contacts: The following potential free contacts shall be available on an optional relay interface board:
   1. Normal operation.
   2. Battery operation.
   3. Bypass operation.
   4. Common fault.
   5. Low battery.
   6. UPS off.

H. Communication Interface Board: A communication interface board shall provide the following communication ports which shall be able to be used simultaneously:
   1. RS232 serial port #1.

2.7 BATTERY

A. The UPS battery shall be of a modular construction made up of trained personnel hot swappable, fused, battery modules. Each battery module shall be monitored for voltage and temperature for use by the UPS battery diagnostic and temperature compensated charger circuitry.

B. The battery jars housed within each removable battery module shall be of the valve regulated lead acid (VRLA) type.

C. The UPS shall incorporate a battery management system to continuously monitor the health of each removable battery module. This system shall notify the user in the event a failed or weak battery module is found.

2.8 ACCESSORIES

A. Maintenance Bypass Panel/Cabinet (MBC): For purposes of providing a external bypass to the UPS system, an external (3) Circuit Breaker Maintenance Bypass panel shall be provided. The Breakers included are for the UPS Input (Q1), UPS Output (Q2) and Bypass breaker (Q3). The bypass Panel shall also include (2) output distribution breakers each rated at 250AF/225AT (D1) and (D2). Provide All Electrical and communications wiring to and from the Bypass to the UPS.

B. Battery Solutions: For purposes of providing UPS back-up power, provide a battery enclosure. For ease of maintenance the battery enclosures shall house draw-out battery cartridges. Battery cartridges shall interlock in place within the battery enclosure to ensure proper contact. Interlock shall ensure that the customer will not inadvertently withdraw the battery pack in an unsafe manner. The battery solution shall be housed in a standard 24 inch (610 mm) wide, 36 inch (914

mm) deep, 42 U high enclosure. Up to four battery enclosures may be added for increased battery runtime.

C. Software and Connectivity:
   1. Network Adaptor: The ethernet web/SNMP adaptor shall allow one or more network management systems (NMS) to monitor and manage the UPS in TCP/IP network environments. The management information base (MIB) shall be provided in DOS and UNIX "tar" formats. The SNMP interface adaptor shall be connected to the UPS via the Network Management Cart Ethernet Port.
   2. Unattended Shutdown:
      a. The UPS, in conjunction with a network interface card, shall be capable of gracefully shutting down one or more operating systems.
      b. The UPS shall also be capable of using an RS232 port to communicate by means of serial communication to gracefully shut down one or more operating systems during an on battery situation.

D. Remote Ups Monitoring: The following methods of remote UPS monitoring shall be available:
   1. Web Monitoring: Remote monitoring shall be available via a web browser such as Internet Explorer.
   2. RS232 Monitoring: Remote UPS monitoring shall be possible via either RS232 or contact closure signals from the UPS.
   3. Simple Network Management Protocol (SNMP): Remote UPS monitoring shall be possible through a standard MIB II compliant platform.

E. Software Compatibility: The UPS manufacturer shall have available software to support graceful shutdown for the following systems:
   1. Microsoft Windows 95/98/XP.
   2. Microsoft Windows NT 4.0 SP6/2000.
   3. OS/2.
   4. Netware 3.2 – 5.1.
   5. MAC OS 9.04, 9.22, 10.
   6. Digital Unix/True 64.
   7. SGI 6.0-6.5.
   8. SCO UNIX.
   9. SVR4 2.3, 2.41.
   10. SCO Unix Ware 7.0 - 7.11.
   11. SUN Solaris 2.6-2.8.
   12. SUN OS 4.13, 4.14.
   13. IBM AIX 4.3x-4.33g, 5.1.
   14. HP-UX 9.x-11.i.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect/Engineer, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

1. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Installer.

3.2 INSTALLATION

A. General: Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer's written recommendations, and as indicated on the Drawings.

B. Factory-Assisted Start-Up: Factory-trained service personnel shall perform the following inspections, test procedures, and on-site training:
   1. Visual Inspection:
      a. Inspect equipment for signs of damage.
      b. Verify installation per manufacturer's instructions.
      c. Inspect cabinets for foreign objects.
      d. Inspect battery units.
      e. Inspect power modules.
   2. Mechanical Inspection:
      a. Check UPS and external maintenance bypass cabinet internal control wiring connections.
      b. Check UPS and external maintenance bypass cabinet internal power wiring connections.
      c. Check UPS and external maintenance bypass cabinet terminal screws, nuts, and/or spade lugs for tightness.
   3. Electrical Inspection:
      a. Verify correct input and bypass voltage.
      b. Verify correct phase rotation of mains connections.
      c. Verify correct UPS control wiring and terminations.
      d. Verify voltage of battery modules.
      e. Verify neutral and ground conductors are properly landed.
      f. Inspect external maintenance bypass switch for proper terminations and phasing.
   4. Site Testing:
      a. Ensure proper system start-up.
      b. Verify proper firmware control functions.
      c. Verify proper firmware bypass operation.
      d. Verify proper maintenance bypass switch operation.
      e. Verify system set points.
      f. Verify proper inverter operation and regulation circuits.
      g. Simulate utility power failure.
      h. Verify proper charger operation.
      i. Document, sign, and date test results.
   5. On-Site Operational Training: During the factory-assisted start-up, operational training for site personnel shall include, but shall not be limited to, key pad operation, LED indicators, start-up and shutdown procedures, maintenance bypass and AC disconnect operation, and alarm information.

3.3 FIELD QUALITY CONTROL

A. Manufacturer Field Service:
   1. Worldwide Service: The UPS manufacturer shall have a worldwide service organization available, consisting of factory-trained field service personnel to perform start-up,

preventative maintenance, and service of the UPS system and power equipment. The service organization shall offer 24 hours a day, 7 days a week, 365 days a year service support.

2. Replacement Parts: Parts shall be available through the worldwide service organization 24 hours a day, 7 days a week, 365 days a year. The worldwide service organization shall be capable of shipping parts within four working hours or on the next available flight, so that the parts may be delivered to the Owner within 24 hours.

3.4 DEMONSTRATION

A. General: Provide the services of a factory-authorized service representative of the manufacturer to provide start-up service and to demonstrate and train the Owner's personnel.

1. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
2. Train the Owner's maintenance personnel on procedures and schedules related to start-up and shutdown, troubleshooting, servicing, and preventive maintenance.
3. Review data in operation and maintenance manuals with the Owner's personnel.
4. Schedule training with the Owner, through the Architect/Engineer, with at least seven day's advanced notice.

3.5 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to the Installer, that shall ensure that the solid state UPS shall be without damage at time of Substantial Completion.

END OF SECTION 260611